

STATE REGULATORS' PERSPECTIVES ON THE CLEAN POWER PLANT

HEARING BEFORE THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE ONE HUNDRED FOURTEENTH CONGRESS FIRST SESSION

MARCH 11, 2015

Printed for the use of the Committee on Environment and Public Works



Available via the World Wide Web: <http://www.fdsys.gpo.gov>

U.S. GOVERNMENT PUBLISHING OFFICE

94-981 PDF

WASHINGTON : 2015

For sale by the Superintendent of Documents, U.S. Government Publishing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512-1800; DC area (202) 512-1800
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED FOURTEENTH CONGRESS
FIRST SESSION

JAMES M. INHOFE, Oklahoma, *Chairman*

DAVID VITTER, Louisiana	BARBARA BOXER, California
JOHN BARRASSO, Wyoming	THOMAS R. CARPER, Delaware
SHELLEY MOORE CAPITO, West Virginia	BENJAMIN L. CARDIN, Maryland
MIKE CRAPO, Idaho	BERNARD SANDERS, Vermont
JOHN BOOZMAN, Arkansas	SHELDON WHITEHOUSE, Rhode Island
JEFF SESSIONS, Alabama	JEFF MERKLEY, Oregon
ROGER WICKER, Mississippi	KIRSTEN GILLIBRAND, New York
DEB FISCHER, Nebraska	CORY A. BOOKER, New Jersey
MIKE ROUNDS, South Dakota	EDWARD J. MARKEY, Massachusetts
DAN SULLIVAN, Alaska	

RYAN JACKSON, *Majority Staff Director*
BETTINA POIRIER, *Democratic Staff Director*

C O N T E N T S

Page

MARCH 11, 2015

OPENING STATEMENTS

Inhofe, Hon. James M., U.S. Senator from the State of Oklahoma	1
Boxer, Hon. Barbara, U.S. Senator from the State of California	3

WITNESSES

Myers, Michael J., Chief, Affirmative Litigation Section, Environmental Protection Bureau, New York State Attorney General	6
Prepared statement	8
Responses to additional questions from Senator Inhofe and Senator Boxer	20
Nichols, Mary D., Chairman, California Air Resources Board	26
Prepared statement	28
Responses to additional questions from Senator Boxer	33
Responses to additional questions from Senator Sessions	38
Easterly, Thomas, Commissioner, Indiana Department of Environmental Management	41
Prepared statement	43
Responses to additional questions from Senator Boxer	88
Parfitt, Todd, Director, Wyoming Department of Environmental Quality	91
Prepared statement	93
Responses to additional questions from Senator Boxer	99
Nowak, Ellen, Commissioner, Public Service Commission of Wisconsin	101
Prepared statement	103
Responses to additional questions from Senator Boxer	107

ADDITIONAL MATERIAL

Letter from Nature Geoscience; Ocean access to a cavity beneath Totten Glacier in East Antarctica	192
Articles:	
NASA; NOAA find 2014 Warmest Year in Modern Record	197
Washington Post; The melting of Antarctica was already really bad. It just got worse.	200

State Regulators' Perspectives on the Clean Power Plant

WEDNESDAY, MARCH 11, 2015

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 10 a.m. in room 406, Dirksen Senate Building, Hon. James Inhofe (chairman of the committee) presiding.

Present: Senators Inhofe, Boxer, Barrasso, Capito, Crapo, Boozman, Sessions, Fischer, Rounds, Carper, Whitehouse, Merkley, Gillibrand, Markey.

OPENING STATEMENT OF HON. JAMES INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. We will bring this hearing to order.

It is great to have the panel. I had a chance to meet each one of you. I really do think that the most important thing, when we get into these rules and regulations is the State perspective. Because they are the ones who have to carry these things out, have to pay for all this stuff.

So we are here today with State officials on the CO2 regulations for existing power plants. Existing. The Clean Power Plan is unprecedented in the scope, complexity and requirements it will impose on State governments. That is what you guys are going to have to carry out.

The proposal undermines the longstanding concept of cooperative federalism under the Clean Air Act, where the Federal Government is meant to work in partnership with the States to achieve the underlying goals. Instead, this rule forces States to redesign the ways they generate, manage and use electricity in a manner that satisfies President Obama's extreme climate agenda.

To date, we have 32 States who have opposed this rule. There is the chart. There are 32 States that oppose the rule. Twelve States, including my State of Oklahoma, are suing the agency over a lack of authority to promulgate the proposal. Nine States have passed resolutions in their legislatures that express limits to the proposal's application. Five States have passed laws that would limit the proposal's application.

Had the EPA engaged in a meaningful dialog with all these States, the agency would not be rushing ahead to impose such an unfair and unworkable and likely illegal regulation.

While the EPA is busy selling this as a plan to save the world from global warming, we know that this rule will have minuscule

impacts on the environment. In fact, last week during the EPA budget hearing, Administrator McCarthy admitted that the agency has yet to do any modeling that would measure the proposal's impact on temperatures and sea level rise. There is a reason for that. And the reason for that is that NERA, which is a very highly respected group on economic modeling and analysis, used EPA's models and numbers and found that after spending \$479 billion over a 15-year period, we would see the double digit electricity prices increase in 43 States, reduce grid reliability, resulting in voltage collapse and cascading outages. However, the Clean Power Plan will reduce CO₂ concentrates by less than 0.5 percent, global average temperature rise will be reduced by only 0.016 degrees Fahrenheit, and sea level rise would be reduced by 0.3 millimeters, which is the thickness of three sheets of paper.

Further, any perceived benefits will be rendered pointless by the continued emissions growth in India and China. Hold that up higher, that is a good chart there. You can see the problems. This is the whole point that Administrator Jackson was talking about, what we do unilaterally here in the United States isn't going to have that much effect. It doesn't affect other countries.

These results, or lack thereof, show that this rule is not about protecting the environment or saving lives of the local citizenry. This proposal is about expanding the government's control into every aspect of American lives. As MIT climate scientist Richard Lindzen, and Richard Lindzen is noted to be one of the foremost climatologists in the Country, he said, "Controlling carbon is a bureaucrat's dream. If you control carbon, you control life."

EPA's rushed timeline, impractical assumptions and arbitrary mandates pay no mind to the fact that this will be damaging to State economies and local residents. Their proposals are nothing more than a blatant and selfish power grab.

We have been through these arguments multiple times before, most recently when the President failed to garner enough support for cap and trade under a Democrat-controlled House and Senate. We are talking about back when Nancy Pelosi was a majority, so they had the White House and the House and the Senate. They couldn't get a majority vote in order to support this.

So I appreciate very much all of the people coming so we can hear the voices from the States. It is nice of you to take the time to be here.

Senator Boxer.

[The prepared statement of Senator Inhofe follows:]

STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR
FROM THE STATE OF OKLAHOMA

TSCA (Toxic Substances Control Act) is a law that everyone agrees is outdated and in serious need of modernization. I am very pleased that today we have before us a bill with the strong bipartisan support of 9 Democrats and 9 Republicans.— I am proud cosponsor of this bill and hope to move it through Committee by way of constructive and orderly process.

For years Senator Lautenberg worked to update the 1976 law, releasing bill after bill every Congress, and in 2012, he came to me with a clear message; this law will not be updated without bipartisan support and input from all stakeholders. Frank and I held a series of stakeholder meetings, and though that process we got a lot of good information on all sides of the issue and I would in particular welcome Ms. Bonnie Lautenberg to the committee this morning.

Just about 2 years ago, Senator Lautenberg teamed up with Senator Vitter to introduce a bipartisan bill that created not only the first real momentum for meaningful reform, but a foundation for the legislation we have before the Committee today.

We all know that Senator Vitter and myself and our Republican colleagues are not ones to typically offer up bills granting EPA more authority. But in this case I believe it is not only the right thing to do, but the conservative thing to do.

TSCA is not a traditional environmental law that regulates pollutants like the Clean Air or Clean Water Acts—instead it regulates products manufactured for commerce. Under the U.S. Constitution, the job of regulating interstate commerce falls to Congress, not the states. We support this legislation not only because it better protects our families and communities, but because it ensures American industry and innovation can continue to thrive and lead without the impediment of 50 different rulebooks.

It is important to note that today that we have a number of witnesses focused on public health and the environment and none from industry. This is certainly not because no one in industry supports this bill—I would like unanimous consent to place supportive statements in the record from a number of groups including the American Alliance for Innovation which has sent us a letter signed by XX trade associations. The reason the majority has chosen these witnesses is to focus on the health and environmental provisions of the bill, which have been significantly strengthened as the necessary tradeoff for greater regulatory certainty for the regulated as well as better ensuring protections for all Americans, not just those in the few states with a patchwork of programs.

Major environmental laws do not get passed without bipartisan support—Frank recognized that—and the simple fact is that any partisan TSCA reform effort will ensure that nothing gets done and Americans are stuck with a broken Federal system to all our detriment. I hope we get this done to honor Senator Lautenberg's legacy.

OPENING STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator BOXER. Thanks so much, Mr. Chairman. I want to welcome all of our witness. I am very proud that Mary Nichols is here. She is really a legend in our State, and has worked on the environment for her whole adult life. She now is Executive Director of the California Air Resources Board. She is going to describe the successes that we are having.

I am also proud that my home State of California has been a leader in this field. And here is the deal: we are prospering. We have to reduce carbon pollution in order to address dangerous climate change. And we can't wait any longer, because we are seeing the impacts all around us. According to NASA, the 10 warmest years on record occurred since the year 2000. And 2014 was the warmest year on record.

Now, people can put their head in the sand, but that is the fact, and facts are stubborn things. According to a new peer-reviewed research in the proceedings of the National Academy of Sciences, and I trust my colleagues respect the National Academy of Sciences, California's record temperatures are driving the State's extreme drought, and scientists predict it will get worse over the coming decades. And just 2 weeks ago, scientists at NASA and at Cornell and Columbia found that if we fail to act aggressively to cut carbon pollution, we have an 80 percent chance of a mega-drought in the entire west.

In the face of all this peer-reviewed science showing the impacts from uncontrolled dangerous carbon pollution, States really should be working together to find solutions to prevent climate change. Let me say, we know the American people want action. This isn't a guess, this is a poll. In a Stanford poll, 83 percent of Americans, including 61 percent of Republicans, say if nothing is done to re-

duce emissions, global warming will be a serious problem in the future.

So again, you can sit here and say it is not an issue. But the American people are in disagreement with that conclusion.

Ultimately, climate change deniers in the Senate continue to attack the landmark Clean Air Act. Just last week, our majority leader, Senator McConnell, told State governments to ignore the Clean Air Act. Imagine, ignore the law of the land, and one of the most popular legislative actions in our history. So we know we can reduce carbon while growing the economy.

And I want to talk about California here and the Regional Greenhouse Gas Initiative. For New York, it is prospering as well. And we will hear some of that from our witness.

California is on a path to cut its carbon pollution by 80 percent by 2050, as required under our greenhouse gas emissions law in our State, AB 32, and the people who tried to overturn that lost at the ballot.

During the first year and a half of the State's cap and trade program, California added 491,000 jobs, a growth of almost 3.3 percent, which outpaces the national growth rate of 2.5 percent. We are living proof that growing the economy and a safe environment go hand in hand. And we are a very large State. This has benefited the middle class.

It may interest you to know that the Energy Information Administration found last month that California's monthly residential electric bill averaged \$90, compared to Oklahoma's monthly bill, which averaged \$110. Under California's climate program, many consumers are even receiving a twice a year climate credit of \$35. That further lowers their utility bill. So California, New York and other States around the Country should be proud of their leadership in putting forward real solutions to climate change and showing that meeting the goals of the Clean Power Plan will benefit our States and our people.

I look forward to hearing from today's witnesses. Thank you, Mr. Chairman.

[The prepared statement of Senator Boxer follows:]

STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR
FROM THE STATE OF CALIFORNIA

Thank you all for being here today. I ask unanimous consent to place into the record my statement, which lays out several reasons I oppose the Udall-Vitter bill. The bill I introduced with Senator Markey, the Alan Reinstein and Trevor Schaefer Toxic Chemical Protection Act, addresses fundamental flaws in the Udall-Vitter bill. Unfortunately, the Republican majority would not permit it to be considered today.

I want to note the presence of Linda Reinstein, Alan's wife, and Trevor Shaefer who are here today, as well as consumer advocate Erin Brockovich, who endorses the Boxer-Markey bill and opposes the Udall-Vitter bill.

It is clear that in its present form, the Udall-Vitter bill fails to provide the public health protections needed and is worse than current law. This bill still does not have the tools necessary to put safeguards in place—even for the most dangerous toxic substances like asbestos. I would like to enter into the record an analysis by one of the leading legal scholars on environmental law who said:

"[T]he Vitter-Udall-Inhofe bill will not make it easier for EPA to regulate harmful toxic substances When considered in light of its aggressive preemption of State law that would actually remove existing protections in many states, the bill is actually worse than the existing statute from a consumer protection perspective. And the changes to the regulatory standard and the failure to change the standard

for judicial review will provide job security for chemical industry lawyers for years to come.” [Tom McGarity, University of Texas Law Professor, March 17, 2015]

I have never seen such an unprecedented level of opposition to any bill. I want you to see what that opposition looks like, and I ask my staff to stand up now and show you the names of more than 450 organizations that oppose the Udall-Vitter bill. Some of the groups listed include:

- 8 State Attorneys General (California, Massachusetts, New York, Iowa, Maine, Maryland, Oregon, Washington)
- Breast Cancer Fund
- Asbestos Disease Awareness Organization
- Trevor’s Trek Foundation
- Environmental Working Group
- EarthJustice
- Safer Chemicals, Healthy Families
- Association of Women’s Health, Obstetric and Neonatal Nurses
- * American Nurses Association
- Physicians for Social Responsibility
- United Steelworkers

Let me quote from some of the letters we have received in opposition to the bill. The Breast Cancer Fund said this: “The Frank R. Lautenberg Chemical Safety for the 21st Century Act . . . undermines what few health protections from toxic chemicals now exist . . .

It advances the interests of the chemical industry and disregards years of work by health care professionals, scientists, public health advocates and State legislators to enact meaningful reform and to prevent diseases linked to chemical exposure.”

According to the Asbestos Disease Awareness Organization, “The fact that the Vitter-Udall bill will not even restrict, much less ban, the deadly substance that claims 30 lives a day is nothing short of a national travesty. Any Senator who supports this industry proposal is in essence supporting the continuation of the toll asbestos has already had on millions of American families.”

EarthJustice had this to say about the Udall-Vitter bill: “[T]he chemical industry got exactly what it wanted—again.”

The Director of Safer Chemicals, Healthy Families, Andy Igrejas, said: “Firefighters, nurses, parents of kids with learning disabilities and cancer survivors all still oppose this legislation.”

The Attorneys General from New York, Iowa, Maine, Maryland, Oregon and Washington had this to say: “[W]e believe that, rather than bringing TSCA closer to attaining its goal, the draft legislation’s greatly expanded limitations on State action would move that goal further out of reach.”

Massachusetts’ Attorney General says: “On the crucial issue of preserving our state’s abilities to protect the health and safety of the citizens within our borders the bill strays far from a bill that can adequately protect our citizens from the potential risks that may be posed by certain toxic chemicals in commerce.”

According to California’s Attorney General: “In California’s view, this constitutes poor public policy that undermines the fundamental health and environmental protection purposes of TSCA reform.”

And California EPA says, “Unfortunately, rather than reforming TSCA to ensure that State and Federal agencies can efficiently and effectively work together to protect the public, this legislation takes a step backward from what should be the common goal of achieving strong public health and safety protections under a reformed version of TSCA.”

Senator INHOFE. Thank you, Senator Boxer.

We are going to have some introductions, by request, of some of the members of the panel. Let’s start with Senator Barrasso.

Senator BARRASSO. Thank you very much, Mr. Chairman. It gives me great pleasure to bring greetings from the committee to one of those witnesses this morning, who is Todd Parfitt, the Director of the Wyoming Department of Environmental Quality. He has a long history of working in the State of Wyoming and specifically working in this department. You will remember, Mr. Chairman, that our former Wyoming Department of Environmental Quality director, John Corra, testified here a number of years ago. Todd has worked closely with him and has succeeded him and is now our director.

It is interesting, Mr. Chairman, because today, as Todd testifies, he will have worked with a Democrat Governor and a Republican Governor in Wyoming. He has always put Wyoming first. He has done what is best for our State and our environment. So it is a privilege today for me to introduce one of those testifying, the Director of the Department of Environmental Quality for Wyoming, Todd Parfitt.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator Barrasso.

Anyone else here for introductory purposes? I don't believe they are.

We are going to go ahead and start with our testimony. We would like to ask you to do your best to confine your time to the time required. We will start with you, Mr. Myers, then we will to the end, to Ellen Nowak. You are recognized.

STATEMENT OF MICHAEL J. MYERS, CHIEF, AFFIRMATIVE LITIGATION SECTION, ENVIRONMENTAL PROTECTION BUREAU, NEW YORK STATE ATTORNEY GENERAL

Mr. MYERS. Thank you, Chairman Inhofe, Ranking Member Boxer and members of the committee, for inviting me today to testify.

I am Michael Myers, from the New York Attorney General's office. My perspective is slightly different from those of other members of the panel. As an environmental lawyer, I have worked for the past 15 years at the Attorney General's office, counseling State regulators on legal issues related to air pollution and climate change, and also litigating those issues in the courts.

It is particularly appropriate that the committee should seek to hear State perspectives. Because under the provisions of the Clean Air Act that EPA is using for the Clean Power Plan, Section 111(d), States are in the driver's seat. But for us to succeed in this critically important area, each State has to be willing to take the wheel.

From the perspective of a State, New York, that has already taken action to cut power plant greenhouse gas emissions, I have good news for other States: you can significantly reduce these emissions from the power sector and do so in a way that helps grow your economy. New York and other States in the Regional Greenhouse Gas Initiative have reduced greenhouse gases from the electricity sector in our region by 40 percent from 2005 levels. Reinvesting the proceeds from the auction of pollution allowances in renewable and energy efficiency projects has kept down electricity costs in our region.

EPA's Clean Power Plan would build off the work that the RGGI States and others like California have done in this area. The plan would cut greenhouse gases from power plants by about 730 million metric tons, equivalent to the annual emissions of powering half the homes in America.

The shift to cleaner generation would also result in substantial public health benefits, including 150,000 fewer asthma attacks by 2030.

But back to the point I started with: for this plan to work, States have to be willing to step up. Some are discouraging States from

doing so on the grounds that the Clean Power Plan is unlawful. My written testimony highlights why such arguments are meritless.

First, action under Section 111(d) to address greenhouse gases from fossil-fueled power plants is required under the Clean Air Act. The law requires EPA to ensure that States achieve emission reductions from power plants necessary to protect human health and welfare from the harms of carbon pollution.

Second, EPA's regulation of hazardous air pollutants from existing power plants under one provision of the Clean Air Act does not preclude the use of Section 111(d) to require those plants to cut their greenhouse gas emissions. The implication of that claim is that EPA had a choice. It could either use the Act's hazardous air pollution program to cut power plant mercury emissions that poison the fish we eat, or it could combat climate change by using the provision the Supreme Court speaks directly to power plant carbon emissions. Not only does this interpretation defy common sense, it is wrong as a matter of law.

Third, it is clear that EPA has the authority to set substantive emission limitations for States to meet. In the absence of such a benchmark, State plans could vary widely in terms of their stringency and effectiveness. States have a lot of flexibility, however, on how to achieve their emission targets in a way that best suits their respective circumstances.

Fourth, it is also clear that EPA has the authority to interpret the best system of emission reduction to reflect the various ways in which States and utilities have reduced greenhouse gas emissions from the electricity sector. EPA's building blocks approach appropriately recognizes successful strategies, such as cap and invest programs, renewable portfolio standards, and energy efficiency that States and utilities have already shown can significantly reduce carbon emissions and do so cost effectively.

In conclusion, here is what I would urge State regulators to consider. The world's scientists are telling us that we need to act now if we are to have a chance at avoiding catastrophic harms from climate change. Our faith leaders are telling us we have a moral imperative to act. The law, the Clean Air Act, requires us to act. And EPA's plan for cutting greenhouse gases from existing power plants is on sound legal ground.

Both EPA and your fellow States are open to working with you on how best to cut emissions in your State. The time is now for State leadership. So take the wheel.

Thank you for the opportunity to testify. I look forward to answering the committee's questions.

[The prepared statement of Mr. Myers follows:]

U.S. Senate Committee on Environment and Public Works
Hearing on State Regulators' Perspectives on the Clean Power Plan
March 11, 2015 10 a.m.

Testimony of Michael J. Myers, Assistant Attorney General
Environmental Protection Bureau
Office of New York State Attorney General Eric T. Schneiderman

Thank you for this opportunity to submit testimony on the Environmental Protection Agency's proposed Clean Power Plan rule. The New York Attorney General's Environmental Protection Bureau is working with other Attorneys General and with state regulators to evaluate legal issues concerning the proposed rule. Our office has successfully defended New York's participation in the Regional Greenhouse Gas Initiative and is now involved in litigation in the D.C. Circuit Court of Appeals opposing challenges to the proposed Clean Power Plan.

My written testimony will focus on the following four points:

- EPA is required under the Clean Air Act to regulate greenhouse gas emissions from existing power plants under section 111(d);
- EPA's regulation of toxic mercury emissions from power plants under section 112 of the Act does not somehow preclude it from regulating greenhouse gas emissions from power plants under section 111(d);
- EPA has the authority to establish substantive emission limitations for state emission guidelines under section 111(d); and
- EPA has the authority under section 111(d) to interpret the "best system of emission reduction" to reflect the various ways states have successfully reduced greenhouse gas emissions from the power sector.

Background

Eight years ago, the Supreme Court noted that "[t]he harms associated with climate change are serious and well recognized." *Massachusetts v. EPA*, 549 U.S. 497, 521 (2007). As the recent U.S. Climate Action Report prepared by the Department of State succinctly stated: "The scientific consensus . . . is that anthropogenic emissions of greenhouse gases are causing changes in the climate that include rising average national and global temperatures, warming oceans, rising average sea levels, more extreme heat waves and storms, extinctions of species, and loss of biodiversity."¹ According to the National Oceanic and Atmospheric Administration, 2014 was the hottest year on record globally.

¹ U.S. Dept. of State, *United States Climate Action Report 2014* (2014), available at <http://www.state.gov/e/ocs/rls/rpts/car6/index.htm>.

The continued emissions of greenhouse gases, primarily carbon dioxide, lock in further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts to people and ecosystems. Limiting anthropogenic climate change requires substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.² Carbon dioxide emissions from human activities also cause ocean acidification, which harms ecosystems and marine biodiversity, in turn impacting food security and the economy.³

New York has begun to experience adverse effects from climate change. Our rate of sea level rise is much higher than the national average and could account for up to 6 feet of additional rise by 2100 if greenhouse gas emissions are not abated. The approximately 12 inches of sea level rise New York City has experienced since 1900 may have expanded Hurricane Sandy's flood area by about 25 square miles, flooding the homes of an additional 80,000 people in New York and New Jersey alone.⁴ A recent analysis of the frequency and intensity of damaging extreme rainfall events in New York found such events are increasing, consistent with scientists' predictions.⁵ Additional anticipated harms in New York include increased ozone pollution in the New York City area, resulting in worsening asthma rates, and the loss of cold water fisheries like native brook trout in the Adirondack Park.

Significant long-term reductions in greenhouse gas emissions must occur to avoid or reduce these harms. Existing fossil-fueled power plants are the largest U.S. source of greenhouse gases, representing about one-third of those emissions, so we must aggressively curb these emissions to address harms from climate change.

² Intergovernmental Panel on Climate Change (IPCC), *Fifth Assessment Synthesis Report* (Nov. 2014), available at http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_SPM.pdf.

³ International Geosphere-Biosphere Programme et al., *Ocean Acidification Summary for Policymakers, Third Symposium on the Ocean in a High-CO₂ World* (2013), available at <http://www.igbp.net/publications/summariesforpolicymakers/summariesforpolicymakers/oceanacidificationsummaryforpolicymakers2013.5.30566fc6142425d6c9111f4.html>.

⁴ New York City Panel on Climate Change 2015 Report, Chapter 2: Sea Level Rise and Coastal Storms. Ann. N.Y. Acad. Sci. ISSN 0077-8923, available at <http://onlinelibrary.wiley.com/doi/10.1111/nyas.12593/full>

⁵ *Current & Future Trends in Extreme Rainfall Across New York State, A Report from the Environmental Protection Bureau of New York State Attorney General Eric T. Schneiderman* (Sept. 2014) (based on data from the 2014 National Climate Assessment and the National Oceanographic and Atmospheric Administration's Northeast Regional Climate Center), available at http://www.ag.ny.gov/pdfs/Extreme_Precipitation_Report%209%202%2014.pdf.

A number of states, including New York, have moved forward with programs to reduce greenhouse gas emissions from fossil-fueled power plants. For example, New York and the other eight states that are part of the Regional Greenhouse Gas Initiative (RGGI) reduced regional carbon dioxide emissions from the electricity sector by 40 percent from 2005 levels. The RGGI states have shown that by a combination of encouraging shifts to less carbon-intensive fossil fuel generation, increasing reliance on renewable energy, and reducing the demand for generation through energy efficiency, substantial reductions in carbon dioxide emissions are possible over a relatively short period, while supporting economic goals and maintaining grid reliability. An independent analysis found that in the first three years of the RGGI program, the reinvestment of allowance auction proceeds is reducing total energy bills across the region by \$1.3 billion and adding \$1.6 billion to the regional economy, creating an estimated 16,000 jobs in the process.⁶

EPA's Clean Power Plan would build off the successful efforts of leading states, but require *all* states to take action to reduce power plant greenhouse gas emissions. For the first time, each state would have to cut greenhouse gas emissions from existing fossil-fueled power plants (coal, oil, and natural-gas fired plants). With every state taking steps to reduce this pollution, the Clean Power Plan is expected to result in the reduction of 730 million metric tons of greenhouse gases by 2030, equivalent to the annual emissions of about 150 million cars.

Just as the leadership of New York and other states has facilitated national action, so too leadership on the part of the United States in reducing greenhouse gas emissions will encourage international action. We will need to work together with other nations to curb emissions to achieve a level of greenhouse gas concentrations that scientists say is necessary to avoid the worst impacts of climate change. The Clean Power Plan marks a critical step in demonstrating that leadership by putting the U.S. on a path to confront and address this challenge.

1. EPA is Required Under the Clean Air Act to Regulate Greenhouse Gas Emissions from Existing Power Plants Under Section 111(d).

The Clean Air Act requires EPA to regulate categories of stationary sources that cause or contribute significantly to air pollution that may reasonably be anticipated to endanger public health and welfare. 42 U.S.C. § 7411(b). Once EPA lists a source category pursuant to section 111(b), it must establish standards of performance for emissions of air pollutants from new (and modified) sources in that category. *Id.*, § 7411(b)(1)(B). At least every eight years, EPA must review, and as necessary, revise the standards. *Id.* "Standard of performance" is "a standard for emissions of air pollutants which reflects the degree of emission limitation

⁶ Analysis Group, The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States (Nov. 15, 2011), available at: www.analysisgroup.com/uploadedfiles/publishing/articles/economic_impact_rggi_report.pdf

achievable through the application of the best system of emission reduction . . . the Administrator determines has been adequately demonstrated.” *Id.*, § 7411(a)(1).

With certain exceptions discussed below, EPA’s regulation of new sources under section 111(b) triggers its obligation to proceed with rulemaking under section 111(d) for existing sources. Section 111(d) requires EPA to issue regulations that establish a procedure similar to section 110 of the Act under which each state submits to EPA a plan establishing, implementing and enforcing standards of performance for such sources.

It has been New York’s position for more than a decade that EPA must regulate greenhouse gas emissions from new and existing fossil-fueled power plants under section 111(b) and (d). In 2003, New York and six other states notified EPA of their intent to sue the agency for failing to update standards from power plants under section 111(b)(1)(B), including establishing standards for carbon dioxide.⁷ As explained in the notice letter, EPA must establish emission standards for pollutants like carbon dioxide that endanger public health and welfare. In 2006, after EPA revised the performance standards for power plants under section 111(b) without establishing standards for carbon dioxide, New York, Connecticut, California, Delaware, Maine, Massachusetts, New Mexico, Oregon, Rhode Island, Vermont, Washington, the District of Columbia and the City of New York filed a petition seeking judicial review of that failure. *New York v. EPA* (D.C. Cir. No. 06-1322).

And because at that time it was EPA’s position that it lacked authority under the Act to regulate greenhouse gas emissions, New York had separately filed suit, along with other states and nonprofit groups, against the owners of the largest fossil-fueled power plants in the country. In *Connecticut v. American Elec. Power Corp.*, we alleged that the greenhouse gas emissions from those plants were substantially contributing to global warming, and that in the absence of a remedy under the Clean Air Act, we could seek injunctive relief under common law public nuisance. The Supreme Court held, however, that section 111 of the Act “speaks directly” to carbon dioxide emissions from existing power plants and that therefore, the Act “and the EPA actions it authorizes” displaced any federal common law right of action to abate those emissions from those plants. *American Elec. Power Corp. v. Connecticut*, 131 S. Ct. 2527, 2537 (2011) (*AEP*).

Subsequent to the Supreme Court’s decision in *AEP* (and the parties’ settlement of *New York v. EPA*), President Obama issued a Climate Action Plan in June 2013. At the same time, the President issued a memorandum in which he directed EPA to fulfill its statutory duty under sections 111(b) and 111(d) of the Act to regulate power plant greenhouse gas emissions by “build[ing] on State efforts to move toward a cleaner power sector.” The memorandum set forth a schedule for

⁷ Letter from Attorneys General of New York, Connecticut, Maine, Massachusetts, New Jersey, Rhode Island, and Washington to EPA Administrator Whitman (Feb. 20, 2003)

EPA to propose and promulgate rules concerning standards for greenhouse gas emissions for new and existing power plants.

Subsequently, EPA proposed performance standards for greenhouse gas emissions from new power plants in September 2013. That proposal triggered EPA's obligation under section 111(d) to proceed with a rulemaking under section 111(d) concerning the regulation of greenhouse gases from existing power plants. EPA then issued its proposed Clean Power Plan rule in June 2014.

2. EPA's Regulation of Toxic Mercury Emissions from Power Plants Under Section 112 Does Not Somehow Preclude It from Regulating Power Plant Greenhouse Gas Emissions Under Section 111(d).

Some opponents of the Clean Power Plan have sued to block EPA from even finalizing it, contending that EPA lacks the authority to regulate greenhouse gas pollutants from existing power plants under section 111(d) of the Act because EPA is regulating toxic pollutants from some of those same plants under a different provision of the statute, section 112.⁸ Not only does such an interpretation defy common sense, it is erroneous as a matter of law.

Section 111(d) plays an important role in the Act's comprehensive structure for regulating air pollutants from stationary sources by enabling EPA and states to control pollution from existing stationary sources that is not regulated under the National Ambient Air Quality Standards (NAAQS) program (sections 108-110) or the hazardous air pollutant program (section 112). Together, these three programs were designed to ensure that there were "no gaps in control activities pertaining to stationary source emissions that pose any significant danger to public health or welfare." S. Rep. No. 91-1196, at 20 (1970).

Before Congress's 1990 amendments to the Act, section 111(d) required standards for "any air pollutant which is not included on a list published under Section 7408(a)," *i.e.*, NAAQS, "or 7412(b)(1)(A) of this title," a cross-reference to the previous version of section 112's hazardous air pollutant program. *See* 42 U.S.C. § 7411(d) (West 1977). Section 111(d) thus mandated regulation of air pollutants from existing stationary sources that were not otherwise covered by the NAAQS or the hazardous air pollutant program. In 1990, after EPA's delays in regulating hazardous air pollutants "proved to be disappointing," *Sierra Club v. EPA*, 353 F.3d 976, 979-80 (D.C. Cir. 2004), Congress extensively amended section 112. Rather than relying on EPA's listing of air pollutants to trigger their regulation under section 112, Congress listed 189 hazardous air pollutants and directed EPA to list categories of major and area sources for each of these pollutants and to establish emission standards for each source category. 42 U.S.C. §§ 7412(b)(1), (c)(1), (d)(1).

⁸ *In Re: Murray Energy Corp.*, No. 14-1112 (D.C. Cir.) and *West Virginia et al. v. EPA*, No. 14-1146 (D.C. Cir.).

As part of the 1990 amendments, Congress amended section 111(d)'s existing reference to section 112. However, different conforming language from the House and Senate bills amending section 111(d) was included in different sections of the final legislation without being reconciled in conference. The Senate amendment replaced the former cross-reference to § 112(b)(1)(A), which was eliminated by the 1990 amendments, with a cross-reference to that section's replacement, § 112(b): it thus requires section 111(d) standards for "any air pollutant (i) for which air quality criteria have not been issued or which is not included on a list published under section 108(a) or section 112(b)." Pub. L. No. 101-549, § 302(a), 104 Stat. 2399, 2574 (1990). The House amendment replaced the section 112 cross-reference with different language: it requires section 111(d) standards for "any air pollutant (i) for which air quality criteria have not been issued or which is not included on a list published under section 108(a) or emitted from a source category which is regulated under section 112." Pub. L. No. 101-549, § 108(g), 104 Stat. 2399, 2467 (1990). Both amendments were signed into law by the President and appear in the Statutes at Large, but only the House amendment appears in the U.S. Code.

There is no evidence in the legislative history that either house of Congress intended to substantively change section 111(d)'s role in the comprehensive statutory scheme. Indeed, when the Congressional Research Service compiled the legislative history of the 1990 amendments shortly after their enactment, it transcribed the amended Act by including both the House and Senate amendments to section 111(d), noting that the amendments were "duplicative" and simply used "different language [to] change the reference to section 112." *A Legislative History of the Clean Air Act Amendments of 1990*, Vol. 1, at 46 & n.1 (1993).

Nevertheless, some opponents of the Clean Power Plan contend that section 111(d), as amended, cannot be used to regulate greenhouse gas emissions from existing fossil-fueled power plants because EPA is regulating mercury and other toxic emissions from some of those plants (coal and oil-fired plants) under the hazardous air pollutant program. Focusing on the House amendment to section 111(d) only, they contend that because power plants are "a source category which regulated under section 112," the use of section 111(d) to regulate carbon dioxide (and other non-hazardous pollutants) from those plants is barred.

This argument is wrong. As explained below, it is founded on the erroneous premise that the duly-enacted Senate amendment, which would indisputably authorize the use of section 111(d) here, must be ignored. Further, opponents' interpretation is not even a reasonable construction of the House amendment, much less one that is compelled.⁹ As the Supreme Court recently stated in another greenhouse gas regulation case, it is a "fundamental canon of statutory construction

⁹ See, e.g., Nordhaus and Zevin, *Historical Perspectives on Section 111(d) of the Clean Air Act*, 44 Environmental Law Rep. 11096 (Dec. 2014), Appendix A (identifying six plausible readings of the House amendment, under four of which section 111(d) could be used to regulate carbon dioxide emissions from existing power plants)

that the words of a statute must be read in their context and with a view to their place in the overall statutory scheme.” *UARG v. EPA*, 134 S. Ct. 2427, 2441 (2014).

Here, the language of the House amendment, properly read in light of the statutory purpose, structure and legislative history, preserves section 111(d)’s function to regulate emissions of air pollutants not regulated under the NAAQS or hazardous air pollutant programs. For example, the phrase “which is regulated under section 112” is more reasonably read either as referring to the phrase “any air pollutant” or to the combination of “any air pollutant” and “a source category.” Indeed, under the structural change to section 112 in the 1990 amendments, it is pollutant and source category combinations that are “regulated” under section 112. Either of these interpretations is in keeping with the Supreme Court’s holding in the *AEP* case and its reference to the pollutant-specific focus of the language in section 111(d). *See* 131 S. Ct. at 2538, n. 7 (observing that section 111(d) would not apply if the existing sources were regulated for the “pollutant in question” under the NAAQS or hazardous air pollutant programs). So read, EPA’s regulation of power plant mercury emissions under section 112 would not have the counterintuitive result of precluding the use of section 111(d) to regulate carbon dioxide.

There is simply no evidence that when Congress amended the statute in 1990 to strengthen section 112’s hazardous air pollutant program, it intended at the same time to weaken the role of section 111(d) in the statute’s comprehensive structure. To the contrary, in section 112(d)(7), Congress explicitly provided that EPA’s regulation of emissions under section 112 must not impair section 111 requirements for different emissions from the same sources. 42 U.S.C. § 7412(d)(7).

By contrast, the interpretation of section 111(d) urged by some opponents of EPA’s Clean Power Plan would create a large gap in the Act’s comprehensive coverage of emissions from stationary sources. Because sources that emit hazardous air pollutants also emit numerous other harmful pollutants, including carbon dioxide, the implication of opponents’ interpretation is that EPA faced an untenable choice: *either* address dangers associated with power plants’ hazardous air pollutants like mercury under section 112 *or* use section 111(d) to address the “serious and well recognized” climate-change harms caused by power plants’ carbon dioxide emissions. Given the Act’s fundamental purpose “to protect and enhance the quality of the Nation’s air resources so as to promote the public health and welfare and the productive capacity of its population,” 42 U.S.C. § 7401(b)(1), it is difficult to imagine Congress intended EPA to have to make such a choice.

And because the language of section 111(d) is not specific to power plants, opponents’ reading would disable a vital tool for achieving cost-effective emission reductions from many *other* types of sources as well, since the other large stationary sources of greenhouse gases—*e.g.*, oil and gas production facilities, petroleum refineries, and chemical plants—are regulated under section 112 for their hazardous emissions, as required by the statute. Their interpretation also would preclude EPA from using section 111(d) to limit existing sources’ emission of other

harmful pollutants, such as sulfuric acid mist and fluoride compounds, due to the fortuity that sources of those pollutants are also regulated under section 112.

Nothing in the legislative history of the 1990 amendments suggests that Congress intended such a radical result when it replaced section 111(d)'s cross-reference to section 112. Silence in legislative history accompanying a subtle legislative change indicates that Congress did not intend to alter significantly the preexisting scheme. *United States v. Neville*, 82 F.3d 1101, 1105 (D.C. Cir. 1996). Or, as the Supreme Court has stated, Congress "does not . . . hide elephants in mouseholes." *Whitman v. Am. Trucking Ass'ns, Inc.*, 531 U.S. 457, 468 (2001).

The opponents' interpretation of section 111(d) is erroneous for an additional reason: it fails to give legal effect to the duly-enacted Senate amendment. The evidence concerning enactment of the final legislation shows that the Senate amendment was not inadvertently included. After the House amended the Senate's bill and deleted the Senate's seven "Conforming Amendments" (including the revision to section 111(d)), the Conference Committee added the Senate's conforming amendments back into the final bill, and the President signed it into law. Compare S. 1630, 101st Cong. (as passed by House, May 23, 1990) with Pub. L. No. 101-549, § 302(a), 104 Stat. 2399, 2574 (1990).

It is well-established that the text of the Statutes at Large (which here contains both amendments to section 111(d)) governs if there is a conflict with the language in the U.S. Code. *United States Nat'l Bank of Or. v. Indep. Ins. Agents of Am.*, 508 U.S. 439, 448 (1993) ("[D]espite its omission from the Code [a provision] remains on the books if the Statutes at Large so dictates."). Here, there is no question that the Senate amendment would authorize section 111(d) regulation of existing power plant greenhouse gas emissions, thereby yielding a different result than the opponents' interpretation of the House amendment.

Under the scenario in which the two amendments are inconsistent, EPA must have an opportunity to consider both and to try to harmonize them. See *Citizens to Save Spencer Co. v. EPA*, 600 F.2d 844, 872 (D.C. Cir. 1979) (where Congress "drew upon two bills originating in different Houses and containing provisions that, when combined, were inconsistent in respects never reconciled in conference . . . it was the greater wisdom for [EPA] to devise a middle course . . . to give maximum possible effect to both."). EPA's proposed interpretation in the Clean Power Plan, which would allow for continued regulation under section 111(d) of non-hazardous air pollutants from sources regulated under section 112, is consistent with Congressional intent and EPA's historic regulation under section 111(d). See EPA Proposed Rule, Legal Memorandum 26-27.¹⁰

¹⁰ For example, EPA regulates methane and non-methane organic compounds from landfills under section 111(d) while regulating emissions of vinyl chloride, ethyl benzene, toluene, and benzene from those same sources under section 112, 61 Fed. Reg. 9,905 (Mar. 12, 1996) & 40 C.F.R. pt. 63, subpt. AAAA; and regulates fluorides from phosphate fertilizer

3. EPA Has Authority to Establish Substantive Emission Limitations in Emission Guidelines for States Under Section 111(d).

Section 111(d)'s framework gives EPA and states distinct but complementary roles to regulate air pollution from existing sources. EPA issues regulations that establish a procedure similar to section 110 in which each state submits to EPA a plan establishing, implementing and enforcing "standards of performance" for such sources. "In compliance with those guidelines and subject to federal oversight, States then issue performance standards for stationary sources within their jurisdiction." *AEP*, 131 S. Ct. at 2537-38.

EPA must also evaluate the content of state plans under section 111(d) and "prescribe a plan for a state in cases where the state fails to submit a satisfactory plan." 42 U.S.C. § 7411(d)(2). To fulfill its statutory responsibilities, EPA must establish substantive emission limitations. Otherwise, EPA would lack a benchmark against which to evaluate the adequacy of state plans under section 111(d)(2), as the statute requires it to do. Thus, like the section 110 framework and procedure, section 111(d) directs EPA to work hand-in-hand with the states to ensure that each state—through its plan—achieves the reductions that EPA has determined are achievable through the application of the best system of emission reduction that has been adequately demonstrated. This cooperative federalism allows EPA to establish the amount of reductions required, while giving the states flexibility to determine how to achieve, or even exceed, those reductions.

EPA's longstanding interpretation of its authority, as set forth in its implementing regulations, further affirms that it is, at a minimum, *allowed* to establish substantive guidelines. As EPA has explained, if it lacked authority to set minimum substantive guidelines, there is a risk states could set "extremely lenient standards" for those air pollutants subject to regulation only under section 111(d), which would leave "a gaping loophole in a statutory scheme otherwise designed to force meaningful action." *Id.* at 53,343. But EPA does have that authority and has exercised it in establishing substantive requirements in emission guidelines issued pursuant to section 111(d) for states to include in their respective plans.¹¹

plants under section 111(d) and hydrogen fluoride and other pollutants from those sources under section 112, 42 Fed. Reg. 12,022 (Mar. 1, 1977) & 40 C.F.R. pt. 63, subpt. BB.

¹¹ See, e.g., 40 C.F.R. § 60.30d (establishing emission guideline for sulfuric acid production units at 0.25 grams sulfuric acid mist per kilogram of sulfuric acid produced); "Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources: Municipal Solid Waste Landfills, Final Rule," 61 Fed. Reg. 9905, 9907 (Mar. 12, 1996); "Primary Aluminum Plants; Availability of Final Guideline Document," 45 Fed. Reg. 26,294 (Apr. 17, 1980); "Phosphate Fertilizer Plants; Final Guideline Document Availability," 42 Fed. Reg. 12,022 (Mar. 1, 1977); "Kraft Pulp Mills, Notice of Availability of Final Guideline Document," 44 Fed. Reg. 29,828 (May 22, 1979).

At the end of the day, although it is EPA's job to quantify the level of emission reduction required in state plans, the statute leaves it up to the states to design their plans to achieve those reductions based on their own circumstances. Indeed, it is in the interest of each state to have its own plan (rather than having to operate under a federal plan) because EPA might not have available all the tools a state would to achieve the necessary reductions in the most cost-effective manner.

4. EPA Has the Authority to Interpret the "Best System of Emission Reduction" to Reflect the Various Ways States Have Successfully Reduced Greenhouse Gas Emissions from the Power Sector.

EPA has the authority to determine a "best system of emission reduction" that recognizes the various ways states have successfully reduced greenhouse gas emissions from the utility sector. As EPA recognized in the proposed rule, more than half the states now have renewable portfolio standards (RPS) that support specific levels of renewable power generation, in turn displacing generation from existing fossil fuel-fired sources. States also have achieved significant cost-effective emission reductions and saved ratepayers money through efforts to reduce demand for electricity. More than half of the states require utilities to adopt energy efficiency resource standards, reducing demand by a specified amount each year.¹² Other state efforts include energy efficiency standards for consumer products and commercial and industrial equipment, efficiency components within residential and commercial building codes, incentives for consumers to adopt more efficient technologies, and investments in energy efficiency projects.

States' innovative programs provided EPA with valuable data and experience in determining the proposed best system of emission reduction adequately demonstrated for existing power plants. These states have demonstrated that it is possible to obtain substantial reductions in CO₂ emissions in a manner that is cost-effective and maintains grid reliability. EPA's "building block" approach in the proposed rule properly recognizes and builds upon these successful state programs.

The statutory language supports EPA's building block approach. Because the Act does not define the word "system," the assumption is that "the ordinary meaning of that language accurately expresses the legislative purpose," *Engine Mfrs. Ass'n v. S. Coast Air Quality Mgmt. Dist.*, 541 U.S. 246, 252-53 (2004) (quotations and citations omitted). And that meaning is quite broad: At the time Congress created the new source performance standards program in 1970, "system" was defined as "a complex unity formed of many often diverse parts subject to a common plan or serving a common purpose." Webster's Third New Int'l Dictionary of the English Language Unabridged 2322 (1968). This definition is sufficiently

¹² See Am. Council for an Energy-Efficient Econ., *The 2014 State Energy Efficiency Scorecard* 21 (2014), available at <http://www.aceee.org/sites/default/files/publications/researchreports/u1408.pdf>.

broad to embrace not just systems employed at the physical source to limit emissions, but also systems that are not on the plant site but similarly result in emission reductions from the same sources (here, fossil-fueled power plants).

Congress's repeated use of the term "system" in Title IV of the Act in the context of referring to the acid rain cap-and-trade program is further evidence that EPA's interpretation in the proposed rule is lawful. *See, e.g.*, 42 U.S.C. §§ 7651(b) (describing purpose of Title IV as reducing acid-rain causing emissions from fossil fuel power plants and recognizing "emission allocation and transfer system" as a method of compliance), 7651b(b) (providing for "Allowance transfer system") & (d) (providing for "Allowance tracking system"); and 7651c(h)(1)(C) (referring to unit that is subject to emissions limitation requirement that is part of a "utility system").

EPA's approach is further authorized by section 111(d)'s specific reference to section 110. Under section 110, EPA uses its expertise to set NAAQS for designated criteria pollutants that states must attain through implementation of emission limits set forth in their state implementation plans. EPA does not set source-specific emission limitations; that is left to the states. Similarly, in the proposed Clean Power Plan, EPA sets statewide emission goals that represent the best system of emission reduction for each state, and leaves it to each state to determine how to allocate individual emission limitations to meet those goals.

The interpretation of "best system of emissions reduction" in the Clean Power Plan's also would not "rewrite clear statutory terms" or otherwise "alter" statutory requirements in any way. *Cf. Utility Air Regulatory Group v. EPA*, 134 S. Ct. 2427, 2445-46 (2014). Instead, EPA has given meaning to the statute's text by considering the "best" ways to reduce emissions by properly accounting for the approaches states and utilities are using to achieve those reductions. *Cf. Massachusetts*, 542 U.S. at 532 (Congress chose sufficiently broad language in the Act "to confer the flexibility necessary to forestall . . . obsolescence."). It is ultimately states, rather than EPA, that have the authority and discretion to determine the emission reduction measures actually adopted. As EPA specifically recognizes in the proposed rule, under section 111(d), states are free to adopt measures other than those the EPA has determined comprise the best system of emission reduction.

EPA's authority to interpret "system" in section 111 is also not unbounded. Not only must EPA work within the word's ordinary meaning, but the qualifiers "best" and "adequately demonstrated" place important limits on EPA's authority. A body of case law compiled over the past forty years interpreting section 111(b) sets forth criteria EPA must use in determining whether a system is "best" and "adequately demonstrated." So, for instance, the system selected by EPA must be technically feasible and of reasonable cost.¹³ The structure of the proposed Clean Power Plan adheres to these principles.

¹³ *See, e.g., Essex Chem. Corp. v. Ruckelshaus*, 486 F.2d 427,433-34 (D.C. Cir. 1973); *see also* cases cited in 79 Fed. Reg. at 34,879 n. 194-198.

EPA's proposed approach to determining the best system of emission reduction and the flexibility EPA has provided to states in meeting their state emission goals, are not only authorized, but arguably compelled by what is already happening on the ground. EPA's approach reflects existing state and regional programs that have successfully demonstrated that electric power sector-based approaches are practical and effective means of cost-effectively reducing CO₂ emissions. These approaches include reducing electricity demand through demand-side energy efficiency measures, shifting generation away from higher emitting sources to lower or zero-emitting sources (including through RPS), and cap-and-trade programs such as those implemented under California's Global Warming Solutions Act and RGGI. These mechanisms have evolved in response to the integrated nature of the power grid and the fact that this grid is fed by a diversity of fuel sources. Indeed, the Utility Air Regulatory Group previously endorsed a cap-and-trade program to satisfy states' compliance obligations under section 111(d).¹⁴

In short, the interconnectedness and diversity of the electric grid provide unique opportunities to obtain cost-effective emissions reductions while meeting consumer demand and reliability needs, and give regulators significant flexibility in determining how best to meet their specific emission-reduction targets. Nothing in the statute prohibits EPA from using its discretion to harness these attributes, and, in fact, the agency is required to consider demonstrated systems that reduce emissions, as it has done here.

Conclusion

If we are to address harms from climate change, it is critical to reduce greenhouse gas emissions from the largest source: existing fossil fuel power plants. EPA's proposed plan to require all states to reduce emissions from the electricity sector under section 111(d) of the Clean Air Act is lawful. The Clean Power Plan would also properly draw on the experience of states like New York that have successfully reduced greenhouse gas emissions from the power sector by allowing each state to use a variety of tools to achieve these reductions in a way that best suits its particular circumstances.

¹⁴ See Br. of Pet'r Utility Air Regulatory Group (UARG) in *New Jersey v. EPA* (D.C. Cir. No. 05-1097) (Jan. 12, 2007). In that case, not only did UARG argue that nationwide cap-and-trade programs constituted the best system of emission reduction, they contended states should be *required* to adopt such programs to satisfy section 111(d).



STATE OF NEW YORK
OFFICE OF THE ATTORNEY GENERAL

ERIC T. SCHNEIDERMAN
ATTORNEY GENERAL

DIVISION OF SOCIAL JUSTICE
ENVIRONMENTAL PROTECTION BUREAU

April 23, 2015

Hon. James M. Inhofe, Chair
Hon. Barbara Boxer, Ranking Member
Committee on Environment and Public Works
U.S. Senate
Washington, D.C. 20510-6175

Re: Responses to Committee's Follow-Up Questions from March 11, 2015 Hearing on
EPA's Proposed Clean Power Plan

Dear Senator Inhofe and Senator Boxer:

The purpose of this letter is to respond to the follow-up questions sent by Elizabeth Olsen on behalf of the Committee to me on April 14, 2015. For your convenience, I have included the questions below in bold, along with my answers:

- 1. During the March 11th hearing, you were asked whether states should delay planning to implement the Clean Power Plan until all the legal challenges to the proposed and final rules are complete but did not have time to answer the question. Do you think states should delay planning to implement the Clean Power Plan or that the Clean Power Plan should be delayed until all litigation is complete? Please explain your answer.**

Answer: No, implementation of the Clean Power Plan should not be delayed until all litigation is complete. There are several reasons why that would be a bad idea. First, as stated in my testimony, we must act now to reduce greenhouse gas emissions if we are to have a reasonable chance of avoiding catastrophic harms from climate change. Litigation over the rule, once it is finalized, may take years to resolve. We don't have the luxury of waiting to take action to curb greenhouse gas emissions from the largest source of those emissions in the country. And it may be the case that there would be a lag time between implementation of the programs and technologies to reduce emissions and the achievement of actual reductions. Second, there is a well-established legal mechanism that authorizes courts in appropriate circumstances to block rules from going into effect: If challengers to a rule can demonstrate that they are likely to succeed on the merits of their claims that the rule is unlawful, that they would suffer irreparable harm during the litigation without a stay, and that a stay is in the public interest, then the

reviewing court can block the rule from going into effect while its legality is being litigated. There is no reason to depart from that well-established process here. Third, concerns about states not having enough time to prepare plans or to meet the rule's compliance deadlines are exaggerated and premature. States may seek extensions to submit their plans if necessary and EPA is considering comments of states and other commenters to provide more time for states to comply with their emission targets.

Similarly, although states are not required to begin planning for the Clean Power Plan until the rule is finalized, it has been New York's experience that shifting to lower carbon-intensive electricity generation is a win-win for the environment and the economy. As discussed in my testimony, an independent analysis found that in the first three years of the Regional Greenhouse Gas Initiative program, the reinvestment of allowance auction proceeds is reducing total energy bills across the region by \$1.3 billion and adding \$1.6 billion to the regional economy, creating an estimated 16,000 jobs in the process.¹

2. During your testimony you mentioned the impacts from the storm surge of Hurricane Sandy. Can you please describe the impact that storm surge had on the reliability of New York's grid? Can you also describe how inaction to further reduce carbon pollution will impact the reliability of the electric grid?

Answer: Superstorm Sandy resulted in significant disruption to the electric grid. In New York, Superstorm Sandy knocked out power to more than two million people, some of whom had no electricity for weeks or months. Recent sea level rise contributed to these impacts. According to the U.S. Department of Energy (DOE), utilities in the region reported damage to over 7,000 transformers and 15,200 poles.

The failure to take action to reduce carbon pollution and mitigate climate change harms is likely to further undermine reliability of the grid. According to DOE, severe weather is the number one cause of power outages in the U.S., and costs the economy billions of dollars a year in lost output and wages, spoiled inventory, delayed production, and damage to grid infrastructure. For example, in 2003-2012, approximately 679 power outages, each affecting 50,000 customers or more, occurred due to extreme weather.² The scientific consensus is that extreme weather events will increase as a result of climate change. In addition, the electric grid is a dynamic system already undergoing major change dictated by innovations in technology and changes in consumer demands. Although opponents of EPA's Clean Power Plan contend (erroneously, in my view) that planned actions taken to comply with the rule will undermine grid reliability, the greater danger to grid reliability is from stifling the ongoing modernization of a

¹ Analysis Group, The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States (Nov. 15, 2011), available at: www.analysisgroup.com/uploadedfiles/publishing/articles/economic_impact_rggi_report.pdf

² White House, *Economic Benefits of Increasing Grid Resilience to Weather Outages* (Aug. 2013), available at: http://energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf

grid that in many instances dates back to the Thomas Edison design and from direct effects attributable to severe weather and sea level rise exacerbated by greenhouse gas emissions.

* * *

Thank you for inviting to testify before the Committee. Please contact me if you have additional questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael J. Myers", with a long horizontal flourish extending to the right.

Michael J. Myers
Chief, Affirmative Litigation Section
Environmental Protection Bureau
(518) 776-2382
michael.myers@ag.ny.gov



STATE OF NEW YORK
OFFICE OF THE ATTORNEY GENERAL

ERIC T. SCHNEIDERMAN
ATTORNEY GENERAL

DIVISION OF SOCIAL JUSTICE
ENVIRONMENTAL PROTECTION BUREAU

April 30, 2015

Hon. James M. Inhofe, Chair
Hon. Barbara Boxer, Ranking Member
Committee on Environment and Public Works
U.S. Senate
Washington, D.C. 20510-6175

Re: Responses to Additional Questions for the Record from the Committee Following
Up on March 11, 2015 Hearing on EPA's Proposed Clean Power Plan

Dear Senator Inhofe and Senator Boxer:

By letter dated April 23, 2015, I provided answers to two questions for the record posed by Senator Boxer, which I had received from the Committee by electronic mail on April 14. By this follow-up letter, I am providing responses to five additional questions posed by the Committee in a letter dated March 31, 2015, which I received by regular mail on April 23. These additional questions are included below in bold, followed by my answers:

1. Does EPA have authority to require states to take actions that EPA itself has no authority to take?

Answer: EPA has proposed the Clean Power Plan under section 111(d) of the Clean Air Act, which gives EPA and the states distinct but complementary roles to regulate air pollution from existing sources where new sources of that pollution are subject to performance standards under section 111(b). Section 111(d) requires EPA to prescribe regulations that establish a procedure under which each state submits to EPA a plan establishing, implementing and enforcing standards of performance for such sources based on EPA's determination of the "best system of emission reduction" (BSER). 42 U.S.C. § 7411(d)(1). "In compliance with those guidelines and subject to federal oversight, the States then issue performance standards for stationary sources within their jurisdiction." *American Elec. Power v. Connecticut*, 131 S. Ct. 2527, 2537-38 (citing 42 U.S.C. § 7411(d)). EPA must also evaluate the content of state plans under section 111(d) and "prescribe a plan for a state in cases where the state fails to submit a satisfactory plan." 42 U.S.C. § 7411(d)(2).

Here, to determine the BSER for carbon pollution from fossil-fueled power plants, EPA looked at approaches states and utilities have successfully used to achieve emission reductions cost-effectively. With respect to the scope of EPA's authority if it is forced to step in pursuant to section 111(d)(2) because a state has failed to submit a plan that meets Clean Air Act requirements, my understanding is that the agency will be taking comment on that issue when it publishes its proposed federal plan sometime this summer.

2. Does EPA have authority to require states to re-dispatch electricity from coal-fired power plants to gas-fired plants?

Answer: EPA's determination of the BSER in the proposed Clean Power Plan included consideration of several different ways in which states and utilities have cost-effectively reduced greenhouse gas emissions from existing fossil-fueled power plants. One of those strategies is to shift dispatch from relatively more carbon-intensive fueled-plants, such as coal-fired generation, to less carbon-intensive generation (renewables, natural gas, nuclear). But the proposed Clean Power Plan does not require states to re-dispatch coal-fired power plants to gas-fired plants. It merely identifies this option as one of several that states may pursue to comply with their emission reduction targets. And as explained in my answer to question #1, EPA intends to issue a proposed federal plan this summer and take comment on issues such as the scope of the agency's authority if a state fails to submit a section 111(d) plan that meets the statutory requirements.

3. Does EPA have authority to set state renewable portfolio standards?

Answer: EPA considered the proven reduction potential of renewable portfolio standards in determining what constitutes the BSER for carbon pollution from existing fossil-fueled power plants. As EPA recognized, many states have used renewable portfolio standards to cost-effectively reduce greenhouse gas emissions while maintaining system reliability. The proposed Clean Power Plan would not, however, set state renewable portfolio standards. And as explained in my answer to question #1, EPA intends to issue a proposed federal plan this summer and take comment on issues such as the scope of the agency's authority if a state fails to submit a section 111(d) plan that meets the statutory requirements.

4. Does EPA have authority to impose energy efficiency requirements upon individual states?

Answer: EPA considered energy efficiency in its determination of what constitutes the BSER for carbon pollution from existing fossil-fueled power plants. As EPA recognized, many states have implemented energy efficiency measures to cost-effectively reduce greenhouse gas emissions while maintaining system reliability. The proposed Clean Power Plan would not, however, impose energy efficiency requirements on individual states. And as explained in my answer to question #1, EPA intends to issue a proposed federal plan this summer and take comment on issues such as the scope of the agency's authority if a state fails to submit a plan under section 111(d) that meets the statutory requirements.

5. Do you agree that there should be time for judicial review of the existing source rule before States have to begin complying with it?

Answer: Implementation of the Clean Power Plan, once finalized, should not be delayed until all litigation is complete. There are several reasons why that would be a bad idea. First, as stated in my testimony, we must act now to reduce greenhouse gas emissions if we are to have a reasonable chance of avoiding catastrophic harms from climate change. Litigation over the rule, once it is finalized, may take years to resolve. We don't have the luxury of waiting to take action to curb greenhouse gas emissions from the largest source of those emissions in the country. Furthermore, it may be the case that there would be a lag time between implementation of the programs and technologies to reduce emissions and the achievement of actual reductions. Second, there is a well-established legal mechanism that authorizes courts in appropriate circumstances to block a rule from going into effect while its legality is being litigated: If challengers to a rule can demonstrate that they are likely to succeed on the merits of their claims that the rule is unlawful, that they would suffer irreparable harm during the litigation, and that blocking the rule is in the public interest, then the reviewing court can issue a stay for the pendency of the litigation. There is no reason to depart from that well-established process here. Third, concerns about states not having enough time to prepare plans or to meet the rule's compliance deadlines are exaggerated and premature. States may seek extensions to submit their plans if necessary and EPA is considering comments of states and other commenters to provide more time for states to comply with their emission targets.

* * *

Thank you for inviting to testify before the Committee. Please contact me if you have additional questions.

Sincerely,



Michael J. Myers
Chief, Affirmative Litigation Section
Environmental Protection Bureau
(518) 776-2382
michael.myers@ag.ny.gov

Senator INHOFE. Thank you, Mr. Myers.
 Mary Nichols is the Chairman of the California Air Resources Board. You are recognized.

**STATEMENT OF MARY D. NICHOLS, CHAIRMAN,
 CALIFORNIA AIR RESOURCES BOARD**

Ms. NICHOLS. Thank you, Chairman Inhofe, Ranking Member Boxer, members of the committee. Thank you for inviting me to be here. I am Mary Nichols, Chair of the California Air Resources Board, and I am honored to be here to support EPA's proposed Clean Power Plan, which we believe will unlock State innovation across the Country to protect our people and grow our economies.

The framework proposed by EPA is a workable, practical plan that will cut carbon pollution, along with other forms of pollution, with a focus on increasing energy efficiency and the use of cleaner domestic energy sources. It provides an opportunity for a better future.

This is a future that we are already working to create in California. Our success story has been one of bipartisanship. The 2006 California Global Warming Solutions Act was signed by our Republican former Governor, Schwarzenegger, who appointed me to this position, and our Democratic Governor, Jerry Brown, who has reappointed me and also, more importantly, has placed climate change at the core of his agenda, championing our enormously successful carbon market, ramping up green energy programs and working nationally and internationally to spread solutions that will protect our vulnerable citizens, our extremely valuable agricultural industry, our coastline and our forests against the already-growing reality of climate change.

Californians overwhelmingly support our board's efforts to move California toward cleaner and more efficient sources of energy and to address the grave threat that global warming poses to America and to the world.

I am here today to share some of our successes with you and to emphasize that EPA is using its Clean Air Act authority in the way that it was meant to, to spread success across the Country and to encourage each State to develop its own plan to cut carbon pollution and to grow its economy.

I am going to skip some of what is in the prepared testimony, because I really want to focus on the fact that we believe that working together, not just as an environmental agency, but under the direction of our Governor, with the Public Utilities Commission, and our Energy Commission, as well as the independent system operator that controls the transmission wires, we can deliver not only a more resilient energy system but we can also meet and even exceed the targets that EPA has set. We are on track for a third of our State's energy needs to be met by renewable energy by the year 2020. And Governor Brown has established a goal of getting to 50 percent of our energy from renewable resources by 2030.

Our carbon-wide carbon intensity has already fallen by nearly 5 percent since 2009, and it will keep falling. Now, that is not only due to electrical power plants, it is also due to cleaner fuels and cleaner vehicles, which are an integral part of our plan. The power

plan, the EPA power plan, is only one piece of the overall President's climate plan. But it is an important one.

But the main thing I want to emphasize is that this is happening at the same time that California is prospering. We are growing jobs. We are growing our economy faster than the rest of the Country. We have grown our jobs since the carbon market has gone into operation by 3.3 percent. Personal income and wages are up, again, growing at rates well above the national average. Our electric power grid delivers power reliably, resiliently and efficiently, thanks to the continued stewardship of the transmission operators. And as Senator Boxer indicated, power bills are actually down. Californians pay the ninth lowest electricity bills in the Country.

States all across the Country, and we do talk to many of our colleagues, are discovering that clean energy pays big dividends. For example, Oklahoma is on track to exceed its 15 percent renewable energy target for 2015, thanks to a very successful wind energy industry, a policy that has yielded billions of dollars in investment in that State and helped to cut pollution.

And of course, California and Oklahoma are not alone. We know that Texas, often billed as our rival in many ways, leads the Nation in wind industry. Many States in the Midwest, as well as the West and the South, are taking action to ensure their ratepayers and their citizens against risks to reliability that come from dirty and inefficient coal plants by replacing them with cleaner power and energy efficiency investments are being used, again, in States red and blue, to cut power bills.

We think that the Clean Power Plan will encourage States to take broader advantage of strategies that they are already using, saving money and invigorating economies across the Country. And of course, to the extent that they choose to work together around their regional grids, they will do even better, because we all know that a regional approach will be more cost effective for all.

As a result, we believe the net benefits of this plan amount to something like \$48 billion to \$82 billion in 2030, representing lives saved, sick days avoided and climate risks abated, as well as greater productivity, lower costs and a more efficient and secure energy system.

So bottom line is, the Clean Power Plan builds on 40 years of Clean Air Act success, federalism, as the Chairman indicated, and now confronts us with an opportunity to address one of the most severe challenges of our time in a way that can also create new jobs and increase our energy security.

Thank you very much.

[The prepared statement of Ms. Nichols follows:]

**Opening Statement of Mary Nichols
Chairman of the California Air Resources Board**

**Hearing on EPA's Proposed Clean Power Plan
Committee on Environment and Public Works
United States Senate**

March 11, 2015

Chairman Inhofe, Ranking Member Boxer, Members of the Committee, thank you for inviting me today. I am Mary Nichols, Chairman of the California Air Resources Board. I am honored to be here to support EPA's proposed Clean Power Plan, which will unlock state innovation all across the country to protect our people, and grow our economies. The framework proposed by EPA is a workable, practical plan that will cut carbon pollution, with a focus on increasing energy efficiency and the use of cleaner, domestic energy sources. It provides an opportunity for a better future.

That is the future we are creating in California. Our success story has been bipartisan. The California Global Warming Solutions Act was signed by our Republican former Governor Schwarzenegger and our Democratic Governor Jerry Brown has placed climate change at the core of his agenda, championing our enormously successful carbon market, ramping up green energy programs, and working nationally and internationally to spread solutions. Californians overwhelmingly support our Board's efforts to move California toward cleaner and more efficient sources of energy and to address the grave threat global warming poses to America and to the world. I am here today to share some of our successes with you, and to emphasize that EPA is using its Clean Air Act authority just as it should: To spread success stories across the country, and to encourage each state to develop its own plan to cut carbon pollution and grow its economy.¹

The Clean Air Act's Successful State/Federal Partnership

Let me begin by emphasizing that the Clean Air Act is the right tool to use in this effort, as the Supreme Court has recognized.² More than forty years ago, with the passage of the Act, Congress recognized that the states have the primary role in fighting air pollution.³ Under the Act's system of cooperative federalism, EPA sets goals and targets in accordance with the best science, and the states

¹ California's more formal comments on the Clean Power Plan can be found at <http://www.arb.ca.gov/cc/powerplants/ca-comments-2014-clean-power-plan.pdf>.

² See *Utility Air Regulatory Group v. EPA*, 134 S.Ct. 2427, 2441 n.5 (2014) (citing *American Electric Power Co. v. Connecticut*, 131 S. Ct. 2527, 2537 (2011)). See also *Massachusetts v. EPA*, 549 U.S. 497 (2007).

³ 42 U.S.C. §7401(a).

are charged with developing creative plans to achieve those goals. That collaboration has slashed air pollution and delivered literally trillions of dollars of public health and other economic benefits: more than \$40 in benefits for every dollar in costs.⁴ In California – though we have more work to do – we have seen our air quality improve dramatically, even as our economy has boomed and we have added millions of residents. Simply put: the Clean Air Act partnership between EPA and the states works.

The Clean Power Plan Will Extend These Successes – Despite Myths to the Contrary

The Clean Power Plan is firmly rooted in this successful tradition. If anything, it is rather a modest step forward – California is already taking more aggressive action to reduce emissions than the Plan requires – but it is plainly a necessary one. The fact is that the Clean Power Plan is among most flexible environmental measures in US history. EPA has set its state targets based upon effective policies already in use in the states, and has given the states wide discretion on how best to achieve them. Still, we hear what start as legitimate questions from state governments and local utilities blown up into manufactured myths. Let me address four of the most prevalent red herrings.

First myth: There has been much misplaced invective over the Plan's electric system reliability impacts. We have heard this before, because the polluters' pollsters tell them that what will grab the public's attention is the threat that the lights will go out. But time and again, this threat has proven to be overblown. In fact, state air regulators can be expected to design their compliance plans in coordination with their energy agency partners, and have more than a decade to fine tune plan implementation. They have the time and expertise to design and operate workable plans. Federal partners, including the EPA, the Federal Energy Regulatory Commission, and the Department of Energy will work with states to make sure pollution reductions are delivered while enhancing reliability. California's own experience making significantly deeper carbon cuts than EPA is likely to require demonstrates that new, clean, generation and modernized infrastructure will not only maintain but improve system reliability. In light of this experience, it should be unsurprising that a well-respected consultancy has just found that the Clean Power Plan can be implemented consistent with reliability needs through the careful work of state planners.⁵

⁴ See Remarks by EPA Administrator Lisa P. Jackson on the 40th Anniversary of the Clean Air Act (Sept. 14, 2010); US EPA, *The Benefits and Costs of the Clean Air Act from 1990 to 2020* (Mar. 2011); US EPA, *The Benefits and Costs of the Clean Air Act, 1970 to 1990* (1997).

⁵ See The Brattle Group, *EPA's Clean Power Plan and Reliability* (2015), available at: <http://info.aee.net/brattle-reliability-report>.

Second, some have argued that EPA is somehow usurping the state's role in setting energy policy. Not so: EPA is regulating the emissions from power plants, just as Congress and the Supreme Court have told it to do. EPA is not requiring the states to adopt any particular energy policies or programs. Instead, states may choose to take advantage of renewable energy and energy efficiency as one possible way to support emission reductions. Nothing in the Clean Power Plan requires that those policies, if selected, come directly under EPA's ambit: the truth is that the agency is considering state plan designs that draw clear dividing lines between air and energy programs – including a “state commitment with federal backstops” approach under which states air regulators could take credit for energy program-linked emission savings, without putting those programs in their federal climate plans.⁶ California defends its state energy and climate prerogative as zealously as the next state, and we believe that states can comply with the Clean Power Plan without surrendering any authority over their energy programs to the federal government.

Third, we've heard some say that it is too hard for states to work together under the Clean Power Plan. But the benefits of regional cooperation are enormous – after all, the grid already ties us all together. EPA itself forecasts billions of dollars in savings from regional planning,⁷ as do at least two major grid operators,⁸ and EPA is eager to help states work together. In particular, EPA has heard from many of us that states will explore “modular” regional planning – looking for bilateral deals and ways to coordinate our plans, without necessarily constructing one unified regional structure right out of the gate. In the West, for instance, we participate in a regional collaborative discussion that connects a truly diverse set of states – with a wide range of views on EPA's proposal – in a shared “no regrets” effort to investigate our options.⁹ State regulators are pragmatic types, and we are ready to work together to find opportunities to build our economies and protect our climate.

Fourth, and last, some have recently argued that states should simply refuse to submit compliance plans, and let EPA impose federal plans. That is terrible advice. Although I am certain that EPA will do its best to develop a workable federal plan, no state should pass up the chance to chart its own course. State regulators are best placed to develop plans that work for their people. Although

⁶ See 79 Fed. Reg. at 34,902.

⁷ *Id.* at 34,943.

⁸ See MISO, *Carbon Analysis* (2014) (forecasting billions of dollars in annual compliance cost savings from regional planning), available at: <http://www.misomtep.org/carbon-analysis/>; and PJM, *PJM Interconnection Economic Analysis of the EPA Clean Power Plan Proposal* (2015) (also forecasting regional compliance to produce substantial savings), available at: http://www.eenews.net/assets/2015/03/04/document_ew_01.pdf.

⁹ Much of this conversation is coordinated by former Colorado Governor Ritter's Center for the New Energy Economy. See <http://cnee.colostate.edu/p/clean-air-act->

some states may also wish to challenge aspects of EPA's rule, litigation alone is not a compliance plan. Instead, it is a recipe for higher costs and missed investments. I am confident that not only can all states find ways towards a cleaner energy future, all states should seize the chance to design the best futures for themselves.

A Better Future

The Clean Power Plan will help unlock a better future for all of us, if we are willing to work together. In California, our Board, the Public Utilities Commission, the Energy Commission, and the Independent System Operator are working together with our energy sector to cut emissions. We are delivering – with an economy-wide carbon market, with aggressive renewable energy targets, and with an energy efficient economy.¹⁰ We are on track for a third of our state's energy needs to be met by renewable energy by 2020,¹¹ and Governor Brown has established a goal of getting 50% of our energy from renewable sources by 2030. Our economy wide carbon intensity has already fallen by nearly 5% just since 2009, and it will keep falling.¹² And we are prospering: As our carbon market has gone into operation, jobs grew by 3.3% -- outpacing the rest of the country.¹³ Personal income and wages are up -- again growing at rates well above the national average.¹⁴ Our electric power grid delivers power reliably, resiliently, and efficiently thanks to the continued stewardship of our transmission operators.¹⁵ And power bills are down: Californians pay the ninth-lowest electricity bills in the country.¹⁶

States all across the country, with a wide range of political priorities, are discovering that clean energy pays big dividends. Oklahoma, for instance, is on track to exceed its 15% renewable energy target for 2015 thanks to its successful wind energy industry¹⁷ -- a policy that has yielded billions of dollars in investments in the state,¹⁸ and helped cut air pollution. And, of course, states like California and Oklahoma aren't alone: Texas leads the nation in wind energy, many states in the Midwest, West,

¹⁰ See Public Policy Institute of California, *Climate Change* (Feb. 2015) (summarizing California policies), available at: http://www.ppic.org/content/pubs/report/R_215EHR.pdf.

¹¹ California Air Resources Board, *First Update to the Climate Change Scoping Plan* (2014) at ES 2, available at: <http://www.arb.ca.gov/cc/scopingplan/document/updatescopingplan2013.htm>.

¹² *Id.* at ES3.

¹³ Environmental Defense Fund, *Carbon Market California* (2014) at 5, available at: http://www.edf.org/sites/default/files/content/carbon-market-california-year_two.pdf.

¹⁴ *Id.*

¹⁵ See California Independent System Operator, *What Are We Doing to Green the Grid?* (2014), available at: <http://www.caiso.com/informed/Pages/CleanGrid/default.aspx>

¹⁶ *First Update to the Climate Change Scoping Plan* at 27-28.

¹⁷ Energy Information Administration, *Oklahoma State Energy Profile* (2014).

¹⁸ American Wind Energy Association, *Oklahoma Wind Energy* (2014).

and South are avoiding the ratepayer and reliability risks of dirty and inefficient coal plants by replacing them with cleaner power, and energy efficiency investments are cutting power bills in dozens of states.

The Clean Power Plan is designed to encourage states to take broader advantage of strategies that are already saving money and invigorating economies across the country. The result, EPA estimates, will be net benefits of between 48 and 82 billion dollars in 2030.¹⁹ Those benefits represent many lives saved, sick days avoided, and climate risks abated – as well as greater productivity, lower costs, and a more efficient and secure energy system.

Conclusion

The bottom line is that the Clean Power Plan builds on more than forty years of Clean Air Act success. Climate change now confronts us with both an enormous challenge and an enormous opportunity for creating new jobs and increased energy security nationwide. EPA has, sensibly, turned to the states – not Washington, DC, alone – to lead the way. We are ready, and willing, to do so.

¹⁹ 79 Fed. Reg. 34,830, 34,9943 (June 18, 2014).

Responses to Questions for the Record

Mary Nichols, Chairman of the California Air Resources Board

Regarding

The Committee on Environment and Public Works' Hearing on EPA's Proposed Clean Power Plan, Held March 11, 2015

Thanks to the Committee, and to Senators Boxer and Sessions, for this opportunity to further explain my views.

Responses to Senator Boxer:

Q1. At the March 11, 2015 hearing, several witnesses suggested that states may need additional time to comply with the Clean Power Plan. Do you believe that California needs additional time to submit its initial state plan to EPA beyond what the EPA's proposal now allows?

A1. The climate crisis we face is urgent, and California is already working hard to cut carbon pollution from its power sector. We are redoubling our efforts: Governor Brown has just issued an executive order setting a greenhouse gas reduction target for the economy as a whole of 40% below 1990 levels by 2030.¹

Within the power sector, we are on track to meet EPA's targets. Building the plan itself will take careful effort, with our stakeholders, and with other state agencies to ensure our current policies to address climate change work in harmony with the plan we submit, but we are confident that we can get it on time. If we ultimately do need more time, or decide to enter into a regional plan, EPA has provided us with the option of taking extensions, which we appreciate. But our intention now is to submit our plan by summer 2016, as the proposal envisions.

Q2. Could you please describe the steps that California has taken to maintain grid reliability as the State has implemented its carbon pollution reduction program, and whether those measures can inform the national discussion concerning reliability and the implementation of the Clean Power Plan? Can you please also describe how inaction to further reduce carbon pollution will impact the reliability of the electric grid?

A2. The California Air Resources Board (ARB) works very closely with the California Public Utilities Commission, the California Energy Commission, and the California Independent System Operator in order to make sure our activities support and improve grid reliability. ARB also maintains regular contact and has entered into an information sharing agreement with the Federal Energy Regulatory Commission (FERC) to evaluate any potential impacts from the implementation of the State's carbon market.

Our experience is instructive. Over the last years, California has steadily increased its renewable portfolio standard (RPS) requirements, and is on track to meet our 33 percent RPS by 2020. Throughout that process, ARB and the energy, economic, and grid regulators have collaborated to monitor our progress. Consistently, we have found no insuperable challenges. Indeed, we have found our grid to be

¹ See: <http://gov.ca.gov/news.php?id=18938>.

very resilient. For example, even when the San Onofre Nuclear Generating Station, a major resource in Southern California retired, our collaborative efforts preserved grid reliability, and we are now on the road to replacing that station substantially with renewable resources.

In light of these successes, in addition to setting our ambitious overall greenhouse gas emission target, Governor Brown has called on California to attain a 50 percent renewable target by 2030. Once again, we are collaborating to study the reliability implications of this proposal. Although an even more renewable grid will operate differently than today's grid, it is becoming clear that it will operate reliably. Through various rulemaking and study processes, California agencies are developing the tools we will need to support that effort – including, for instance, efforts to support energy storage, and to ensure that we are able to readily exchange energy with our neighboring states.

The Clean Power Plan generally sets less ambitious carbon reduction goals than California is achieving, meaning that any reliable challenges states might address related to the Plan are likely to be substantially less than those which California has already successfully managed. And, as my testimony indicates, the vast majority of analysts who have considered the issue likewise see no insuperable reliability challenges. Coordinated state planning is clearly able to manage any changes to the grid which state planners may decide are appropriate to comply with the rule. Planners have ample tools to address these issues, as California has shown – but those tools are certainly not limited to California. Energy and economic regulators across the country have long worked to manage a changing power fleet while providing reliability, supported by FERC's efforts and technical assistance. The same process will work here.

Importantly, as your second question suggests, reliability and grid services generally may actually be impaired, in some circumstances, by *failing* to decarbonize the grid. This is true for several reasons. First, aging fossil plants are likely to become less reliable over time, and to experience increased operating costs. So diminishing reliance on these plants will help support a more durable power system. Second, renewable resources and the grids that integrate them are flexible: These systems have many different resources across a wide geography supporting power demand and so are less susceptible to disruptions at any one facility. Third, because renewable resources are not tied to variable fossil fuel costs, improving their profile in the grid reduces sensitivity to fuel price shocks and supply disruptions. In short, states that diversify their power mixes away from fossil plants are likely to experience a wide range of benefits. Fourth, climate change itself is a threat to grid reliability: Heating and cooling demands associated with a changing climate stress power demand, and the physical manifestations of climate change can impair power supply and transmission – forest fires can cut power lines, and droughts reduce hydroelectricity availability, for example.

Q3. At the March 11, 2015 hearing, there was a discussion related to ensuring the Clean Power Plan does not negatively impact low-income and disadvantaged communities. Can you please describe the programs and measures that California has taken to provide benefits to these communities as the State implements its carbon reduction program?

A3. California is deeply focused on making sure its climate change programs benefit disadvantaged communities, and we will be investing hundreds of millions of dollars to make good on that commitment.

Let me begin by emphasizing that California's programs, and the Clean Power Plan, have special importance to lower-income communities and to communities of color because members of those

communities have disproportionately suffered from emissions from fossil-fired power plants and other sources of air pollution. The same communities, all too often, are especially vulnerable to climate change, which, if unchecked, will exacerbate air pollution problems, as well as destabilizing the economic foundations that support so many people. Therefore, California views addressing climate change as part of building a more just, and equitable, country for all people. It is important to recognize that many other states and organizations, including the NAACP, take the same perspective.²

Within California, our efforts fall into two major streams: First, ensuring that our programs reduce pollution in disadvantaged communities, and, second, investing directly in those communities to support further greenhouse gas reductions.

As to the first point, AB 32, our landmark global warming statute is among several authorities that direct ARB to design its programs, including its carbon market, to protect disadvantaged communities. In 2001, ARB adopted its core policies for environmental justice, and it continues to act on those efforts, guided by an independent Environmental Justice Advisory Committee. Consistent with these policies and our statutory authorities, our climate programs have been designed to support our pollution reduction efforts across the state, and to react appropriately to any public health risks. As our recent Update to our Climate Change Scoping Plan explains, California works to “ensure that its climate programs, policies and actions also result in benefits to environmental justice communities.”³ This includes an ongoing effort to carefully monitor and address any localized emissions increases that might otherwise occur as the result of our carbon market programs. If ARB does identify any such impacts, we are committed to swiftly and appropriately addressing them, in order to ensure that climate change mitigation efforts protect all Californians.⁴

Second, California’s climate change programs invest directly in these communities. By statute, the Administration is required to allocate at least 25 percent of the State’s portion of the Cap-and-Trade auction proceeds in projects that benefit disadvantaged communities, and 10 percent of the proceeds to projects directly within and benefiting those communities.⁵ We are meeting and exceeding these goals. In fiscal year 2014-15, for instance, we expect that over 30 percent of appropriations from these revenues will benefit disadvantaged communities – an investment of approximately \$275 million.⁶ As auction proceeds expand, these investments will reach billions of dollars annually.

California also return some of the auction revenues to households directly via the California Climate Credit, an on-bill credit available to customers of investor-owned utilities, electricity service providers, and of community choice aggregation providers. This helps defray energy costs and for these customers, further benefiting Californians, including those who might otherwise struggle to make ends meet.⁷

² See, e.g., NAACP, *Coal-Blooded: Putting Profits Before People*, available at: <http://www.naacp.org/page/-/Climate/CoalBlooded.pdf>.

³ ARB, *First Update to the Climate Change Scoping Plan: Building on the Framework* (2014), at 128, available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf.

⁴ See *id.*

⁵ *Id.* at 128-29.

⁶ ARB, *Investments to Benefit Disadvantaged Communities*, at 13-14 (2014), available at: <http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/final535-interim-guidance-11-3-2014.pdf>.

⁷ See generally: <http://www.cpuc.ca.gov/PUC/energy/capandtrade/climatecreditfaq.htm>.

Our climate change programs not only reduce pollution that threatens communities at risk – they work to support and enhance opportunities for Californians who otherwise face significant challenges. We are proud that our programs ensure that the solution to this global problem translates into real improvements, every day, in communities across our state.

Q4. At the March 11, 2015 hearing, it was suggested that state-based programs or actions designed to reduce carbon pollution would compel manufacturing to emigrate from such states. Can you please describe what has happened to the industrial and manufacturing sector in California as the State's carbon pollution reduction programs were implemented?

California has nearly 1.3 million manufacturing jobs – the most of any state in the country – and produces hundreds of billions of dollars in manufactured goods.⁸ Like many states, our state was hit hard in the Great Recession, but we never lost our dominant position nationally. Now, we are building our way back and growth in the sector has been steady since 2010.⁹ Thus, our recovery has been taking place at the same time as our Cap-and-Trade market began its full operations.

We carefully designed our carbon market to maintain support for our industrial economy. Our carbon market allocation policies ensure that regulated companies remain competitive, reduce their emissions, and share in our collective prosperity. Careful market design and allocation decisions reward efficient companies, while ensuring that California retains and builds a broad economic base.¹⁰

Our climate policies have supported our economy. As I indicated in my testimony, California's overall job growth and economic growth are significantly above the national average. Our green energy sector is also booming – jobs in that sector are growing faster than the overall state growth rate, and California has seen approximately \$21 billion in clean technology venture capital investment since AB 32 was signed into law.¹¹

California's experience is that investing in sensible climate policies helps to drive significant economic activity. The 21st century economy will reward companies that can deliver low-carbon products and energy, and we are pleased that our policies continue to enable Californians to compete in that economy. The Clean Power Plan will enhance the competitiveness of the United States in the same way.

Q5. How will EPA's new proposed National Ambient Air Quality Standard for Ground-Level Ozone (Ozone NAAQS) affect California's compliance with the Clean Power Plan?

The Clean Power Plan and the Ozone NAAQS are both necessary public health measures that support each other. Reducing greenhouse gas pollution will help ameliorate the conditions that form ground-level ozone. Fully reducing ground-level ozone requires us to develop low- or zero-emitting sources of power, among other technological innovations. We believe that both rules, operating together, will help protect all Americans and support a stronger, healthier, country.

⁸ Bureau of Labor Statistics, *Economy at a Glance: California* (2015), available at: http://www.bls.gov/eag/eag_CA.htm.]

⁹ See *id.*

¹⁰ See generally <http://www.arb.ca.gov/cc/capandtrade/allowanceallocation/allowanceallocation.htm>.

¹¹ EDF, *Carbon Market California, Year Two*, at 6 (2015), available at: http://www.edf.org/sites/default/files/content/carbon-market-california-year_two.pdf.

This is especially important to ARB because California has the most challenging ground-level ozone problems in the nation, and ARB and its partner air districts are committed to developing comprehensive solutions to meet the ozone NAAQS. To that end, ARB recently filed comments on EPA's proposed ozone NAAQS.¹² In those comments, we urged EPA to carefully consider the best available science, which indicates that a NAAQS set at the 60 ppb level may be necessary to protect public health. Those comments explain our views more fully, as follows:

[A] significant number of individuals would still likely experience adverse health effects with a standard set between 0.065 and 0.070 ppm. There will be a number of days where ozone levels fall above levels that resulted in lung function decrements in healthy individuals in a number of studies. Even more concerning, children, elderly individuals and asthmatics, all recognized as vulnerable groups, are expected to show even stronger adverse respiratory and other effects from prolonged exposure to ozone at these levels. Thus, a more stringent standard at 0.060 ppm, within the range proposed by CASAC would provide a more appropriate margin of safety and further provide health benefits not only to the most vulnerable Americans, but also to healthy people.

Strengthening the ozone standard would provide health benefits for California, particularly in the South Coast Air Basin and the San Joaquin Valley, such as reductions in premature mortality, hospitalizations, emergency department visits for asthma, and lost work and school days. Nearly two-thirds of the State's population resides in these two extreme nonattainment areas, including large numbers of Californians with well-established health risk factors such as children and the elderly, as well as with asthma and other chronic heart and lung diseases. ...

Strengthening the ozone NAAQS will also provide significant economic benefits to California. These benefits are tied to reduced health care costs and fewer lost work days and school absences. Also, as discussed in the Policy Assessment, ARB and OEHHA anticipate that improvement in air quality because of a more stringent ozone NAAQS will result in reduced damage to the State's crops, as well as its forests, and ecosystems. The latter will, in turn, reduce tinder accumulation and will help to reduce risk of wildfires, which also affect air quality.

... [M]eeting the current and a revised standard ... will require large emission reductions across all source sectors and the use of zero and near-zero technologies, improved infrastructure, along with the cleanest fuels. These efforts to meet more health protective standards will also support a broad range of public health goals including meeting Governor Brown's initiatives to reduce petroleum usage 50 percent by 2030 and achieving steep reductions in carbon pollutants to address the ongoing threat posed by climate change.

.... Although it will be a challenge to attain more stringent standards, evidence-based health science shows that strengthening the ozone NAAQS is necessary to protect public health in California and the nation.¹³

Q6. The 2014 National Climate Assessment found:

"Factors that affect ozone formation include heat, concentrations of precursor chemicals, and methane emissions, while particulate matter concentrations are affected by wildfire emissions and air stagnation

¹² Available at: <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2008-0699-3438>.

¹³ See *id.*

episodes, among other factors. By increasing these different factors, climate change is projected to lead to increased concentration of ozone and particulate matter in some regions.”

Does CARB accept this peer-reviewed scientific finding? Can you please describe any air pollution reduction co-benefits that California will accrue from reducing carbon pollution?

Yes, we strongly believe that formation of dangerous ozone and particulate pollution will be exacerbated by climate change in many regions, including in regions in California. California’s efforts to greatly reduce combustion emissions from electricity, industry, and transportation, among other sources will therefore have two-fold public health benefits: They will help reduce climate change risks, while also directly reducing the emissions of combustion by-products (NO_x, PM, SO_x, and other compounds) that contribute to the formation of ozone and particulate matter pollution that threatens public health.

Responses to Senator Sessions:

Q1. During your testimony, you referenced Energy Information Administration (EIA) data in suggesting that average, monthly residential electric bills were low in California compared to other states. However, according to EIA, in 2013 the average retail electric price for residential customers in California was 16.19 cents kWh, compared to 11.26 cents kWh in Alabama. Do you agree that the cost of electricity on a cents/kWh basis is higher in California than in Alabama and most other states?

California’s energy bills are among the very lowest in the country. Although it is true that California has comparatively high electricity rates, consumers do not pay a rate: They pay a bill. Those bills are generally calculated by multiplying the electricity rate times the amount of power a consumer uses. Because California has invested in energy efficiency, our residents use less energy for a given task than in many other states. As a result, our total bills are low. In fact, as of January 2015, the EIA reported that California has the seventh lowest electricity bills in the country – an improvement in our ranking relative to the older the data on which my testimony was based.¹⁴

According to that EIA report, California’s average monthly residential energy bill is \$90.19. The national average bill is \$107.28, so we are doing much better than the country as a whole in providing low-cost electricity to our residents. Alabama’s average bill, by contrast, is \$136.36—tying it for the second highest energy bills in the country.

Thus, this question’s rate comparison is uninformative on the core question of what our residents experience. California may have higher electricity rates, but we power our economy efficiently, saving money throughout the economy. And, as I noted in my responses to Senator Boxer, we are working to further defray utility bills, including through the California Climate Credit.

Q2. During the March 11 hearing, Senator Sessions asked whether electricity prices will go up as a result of [the] Clean Power Plan. You responded, “You know, there has been a trend, I would say, over decades, for the cost per unit of electricity to go up. But what we think is important is the bill, what the customer actually sees. And in that event, we are holding steady. We are able to hold that steady.” You then indicated that electricity bills would remain ‘steady’ under the Clean Power Plan.

¹⁴ EIA, *Electricity Monthly Update: January 2015* (2015), available at: <http://www.eia.gov/electricity/monthly/update/>.

a. Please confirm whether, as a result of the Clean Power Plan, electricity prices in California will increase or decrease on a cents/kWh basis. Please provide all data, analyses, and other evidence you reviewed and relied on to reach your conclusion.

Initially, because we expect California's current policies to achieve greater carbon reductions than are required by our federal targets, we do not expect our federal compliance plan to impose significant new costs on Californians.

Further, electricity bills – rather than rates – are the critical unit of analysis. The evidence cited in my testimony and discussed above – documenting California's continuing success in delivering some of the lowest bills in the nation while decarbonizing its power sector far more aggressively than the Clean Power Plan requires nationally – supports my conclusion that the Clean Power Plan will not have significant negative electricity cost impacts.

Further, EPA's analysis in its Regulatory Impact Analysis for the proposed Clean Power Plan supports my conclusions.¹⁵ That analysis is based on carefully designed and comprehensive modeling using the Integrated Planning Model (IPM), and so is rigorous and convincing. Although the precise contours of electricity rates and bill changes will depend upon state compliance plan decisions that have not yet been made, that analysis projects that while electricity *rates* in California and the country may slightly increase, electricity *bills* will fall as energy efficiency investments bear dividends and the use of costly aging fossil plants decreases.¹⁶ EPA projects that national average electricity bills will fall by 8.7% relative to business as usual as the result of the Clean Power Plan.¹⁷ Power bills in California can be expected to follow this general trend. This conclusion is based upon national electric system modeling, including EIA data, and should be accepted as reliable and useful projections.

The Clean Power Plan can realistically be expected to save many Americans money every month on their electricity bills. That is what we have experienced under California's similar policies.

b. Please provide all data, analyses, and other evidence which warranted your conclusion that electricity bills would remain "steady" under the Clean Power Plan.

See my response to question 2a above. As that response reflects, my conclusion was arguably unduly conservative: In fact, according to EPA's careful analysis using the rigorous IPM model, the Clean Power Plan will likely *reduce* electricity bills.

I would also refer the Committee to a persuasive independent report on these issues by the Analysis Group, whose authors include a former Assistant Secretary to the Department of Energy and the former Chair of the Massachusetts Department of Public Utilities.¹⁸ That report comprehensively surveys

¹⁵ Available at: <http://www2.epa.gov/sites/production/files/2014-06/documents/20140602ria-clean-power-plan.pdf>.

¹⁶ See *id.* at 3-42 – 3-43.

¹⁷ *Id.* at 3-44, Table 3-24.

¹⁸ Paul Hibbard, Andrea Okle, & Sue Tierney, *EPA's Clean Power Plan: State's Tools for Reducing Costs and Increasing Benefits to Consumers*, The Analysis Group (2014), available at: http://www.analysisgroup.com/uploadedfiles/publishing/articles/analysis_group_epa_clean_power_plan_report.pdf.

states' broad authorities to design compliance plans that will protect consumers. The authors conclude that "[b]ased on our own analysis and experience, we believe that the impacts on electricity rates from well-designed CO₂-pollution control programs will be modest in the near term, and can be accompanied by long-term benefits in the form of lower electricity bills and positive economic value to state and regional economies."¹⁹ This conclusion accords with California's experience.

c. Do you agree that it is important for customers to review and understand the cost of electricity on a cents/kWh basis when they are attempting to pay their electricity bills?

Although electricity rates are, of course, relevant to customers' understanding -- and a rate analysis may encourage further conservation measures -- what ultimately matters is the total amount of electricity consumed, and, hence, the amount of the bill. As I have explained, energy efficiency investments, among other policies supported by the Clean Power Plan, result in lower power bills.

The Clean Power Plan will likely help to cut power bills, rather than increase them. It will also unlock further benefits: Properly implemented, it will enhance grid reliability, reduce the risk of climate change, and support public health. Its benefits will be particularly important in states like Alabama, which now face very high bills and are very dependent on fossil power. California looks forward to working with EPA, and with other states, to help ensure that all Americans benefit from these policies.

¹⁹ *Id.* at 1.

Senator INHOFE. Thank you, Ms. Nichols.

Thomas Easterly is Commissioner of the Indiana Department of Environmental Management. You are recognized.

**STATEMENT OF THOMAS EASTERLY, COMMISSIONER,
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT**

Mr. EASTERLY. Thank you, Chairman Inhofe, Ranking Member Boxer and members of the committee. Good morning.

My name is Thomas Easterly and I am the Commissioner of the Indiana Department of Environmental Management, also known as IDEM. I bring you greetings from Governor Pence of Indiana, and I appreciate the opportunity to share with you Indiana's current perspective on the Environmental Protection Agency's 111(d) regulations for fossil fuel electric generating units.

The proposed regulations will detrimentally impact Indiana for a number of significant reasons. We are the most manufacturing-intensive State in the United States. More than 80 percent of Indiana's electricity comes from coal. We have a 300-year supply of coal in our State, and 28,000 Hoosiers are employed in the coal industry. We recognize that we need all forms of energy to power our economy, and the Pence administration is developing an updated energy plan for the State that will foster greater use of renewables and other energy sources. At the same time, we know that coal is a crucial Hoosier energy resource that must continue to be utilized.

IDEM's mission is to protect Hoosiers and our environment. Following the release of the proposed rule, my office carefully examined the proposal in light of our mission. We also engaged private sector stakeholders and other State agencies in an extensive review of the proposal and its potential impacts. Our analysis came to only one conclusion. This proposal will cause significant harm to Hoosiers and most residents of the United States without providing a measurable offsetting benefits.

For those reasons, Indiana's Office of Energy Development, Office of Utility Consumer Counselor, Department of Natural Resources, Utility Regulatory Commission and my agency filed joint comments urging the USEPA to withdraw this proposal. A copy of the joint comments and a letter from Governor Pence that accompanied the joint comments has been shared with the committee.

The most ironic impact of the proposed regulations is that they are likely to increase worldwide greenhouse gas emissions by decreasing the international competitiveness of U.S. businesses due to increased energy costs. Competitive businesses have been investing in cost-effective energy savings activities for decades. Under this proposal, the total cost of the products produced in the United States will need to increase, eroding our international competitiveness and resulting in the loss of manufacturing jobs in Indiana and across the Nation.

When these businesses close, U.S. emissions will decrease. But worldwide greenhouse gas emissions will increase, as our businesses move to areas with less efficient and more carbon-intensive energy supplies.

Indiana once held a competitive advantage due to our low cost of electricity. But not anymore. Indiana's low cost of electricity advantage has slipped and EPA regulations have significantly con-

tributed to that change in position. The State Utility Forecasting Group in Indiana has forecast that a 30 percent increase in Indiana electrical costs, in part, from USEPA regulations already in place, and the 111(d) proposal will add additional costs on top of that 30 percent. USEPA itself predicts that its 111(d) proposal will increase the cost of natural gas and the cost per kilowatt hour of residential electricity by about 10 percent in the next 6 years. Furthermore, increases in energy costs hit the poor, elderly and most vulnerable in our society first. At a time when Indiana is doing all that it can to grow its economy and create jobs, the EPA's proposal creates a very real possibility that the increased energy costs will slow our economic progress and raise people's utility bills.

In Indiana, we are obviously concerned about the economic impact of EPA's proposed rules on business and consumers, but we have also filed 31 pages of technical comments. We want to make sure the rule does not result in unintended consequences, such as reduced reliability resulting in brownouts, or not yet having all of the necessary infrastructure in place to convert from coal to natural gas. For purposes of due diligence, Indiana is evaluating all available responses to the proposed regulations from submitting a State plan to participating in a regional approach or simply refusing to comply at all, known as the just say no option.

However, the fact that this misguided policy will harm Hoosiers and other people in our Country while actually increasing the worldwide level of the very emissions it is designed to decrease compels Indiana to oppose the proposed regulations.

Thank you for the opportunity to share our views and I welcome your questions.

[The prepared statement of Mr. Easterly follows:]

Testimony of Thomas Easterly
Commissioner, Indiana Department of Environmental Management
to the
U.S. Senate
Committee on Environment and Public Works

“State Perspectives: Questions Concerning
EPA’s Proposed Clean Power Plan”
March 11, 2015

Washington, DC

Chairman Inhofe, Ranking Member Boxer and Members of the Committee, good morning, my name is Thomas Easterly. I am the Commissioner of the Indiana Department of Environmental Management, also known as IDEM. I bring you greetings from Governor Pence of Indiana, and I appreciate the opportunity to share with you Indiana’s current perspective on the Environmental Protection Agency’s proposed 111(d) regulations for fossil fueled Electrical Generation Units.

The proposed regulations will detrimentally impact Indiana for a number of significant reasons. We are the most manufacturing intensive state in the U.S. More than 80% of Indiana’s electricity is currently produced by coal. We have a 300-year supply of coal in our State, and 28,000 Hoosiers are employed in the coal industry. We recognize that we need all forms of energy to power our economy, and the Pence Administration is developing an updated energy plan for the State that will continue to foster greater use of renewable and other energy sources. At the same time we know that coal is a crucial Hoosier energy resource that must continue to be utilized.

IDEM's mission is to protect Hoosiers and our environment. Following the release of the proposed rule, my office carefully examined the proposal in light of our mission. We also engaged private sector stakeholders and other state agencies in an extensive review of the proposal and its potential impacts. Our analysis came to only one conclusion: This proposal will cause significant harm to Hoosiers (and most residents of the U.S.), without providing any measurable offsetting benefits. For these reasons, Indiana's Office of Energy Development, Office of Utility Consumer Counselor, Department of Natural Resources, Utility Regulatory Commission and my Agency filed joint comments urging the U.S. EPA to withdraw this proposal. A copy of the joint comments and a letter from Governor Pence that accompanied the joint comments has been shared with the Committee.

The most ironic impact of the proposed regulations is that they are likely to increase worldwide greenhouse gas emissions by decreasing the international competitiveness of U.S. businesses due to increased energy costs. Competitive businesses have been investing in cost effective energy savings activities for decades. Under this proposal, the total cost of the products produced in the U.S. will need to increase eroding our international competitiveness and resulting in the loss of manufacturing jobs in Indiana and across the nation. When these businesses close, U.S. emissions will decrease, but worldwide greenhouse gas emissions will increase as our businesses move to areas with less efficient and more carbon intensive energy supplies.

Indiana once held a competitive advantage due to our low cost of electricity. Not anymore. Indiana's low cost of electricity advantage has slipped, and EPA regulations have significantly contributed to that change in position. The State Utility Forecasting

Group (SUFG) in Indiana has forecasted a 30% increase in Indiana electrical costs in part from U.S. EPA regulations already in place, and the 111(d) proposal will add additional costs on top of that 30%. U.S. EPA itself predicts that its 111(d) proposal will increase the cost of natural gas and the per KWHr cost of residential electricity by around 10% in the next 6 years. Furthermore, increases in energy costs hit the poor, elderly and most vulnerable in our society first. At a time when Indiana is doing all that it can to grow its economy and create jobs, the EPA's proposal creates the very real possibility that increased energy costs will slow our economic progress and raise people's utility bills.

In Indiana, we are obviously concerned about the economic impact of the EPA's proposed rules on businesses and consumers, but we also have filed 31 pages of technical comments. We want to make sure the rule does not result in unintended consequences such as reduced reliability (brownouts) or not yet having all of the necessary infrastructure in place to convert from coal to natural gas.

For purposes of due diligence, Indiana is evaluating all available responses to the proposed regulations from submitting a state plan, to participating in a regional approach, or simply refusing to comply at all, known as the "just say no" option. However, the fact that this misguided policy will harm Hoosiers and other people in our country while actually increasing the worldwide level of the very emissions it is designed to decrease compels Indiana to oppose the proposed regulations. I thank you for the opportunity to share our views and welcome your questions.



STATE OF INDIANA
OFFICE OF THE GOVERNOR
State House, Second Floor
Indianapolis, Indiana 46204

Michael R. Pence
Governor

December 1, 2014

The Honorable Gina McCarthy
Administrator
United States Environmental Protection Agency
1200 Pennsylvania Ave NW
Washington, DC 20460

Re: "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units" under the Clean Air Act Proposed Rule, June 18, 2014, 79 Fed. Reg. 34830

Dear Administrator McCarthy:

I write to express my great dismay and strong opposition to the proposed rules designed to reduce carbon dioxide emissions from existing power plants. I urge you to withdraw the proposed rules without delay.

The proposed rules are ill-conceived and poorly constructed. They exceed the legal authority granted to the U.S. Environmental Protection Agency (EPA) under the Clean Air Act. They seek to fundamentally restructure how our electricity grid functions while making our electricity less reliable. They will contribute to higher electricity prices at a time when our economy can least afford it. They will drive investment to other countries instead of creating jobs here at home. In short, the proposed rules will hurt Indiana and the rest of the country.

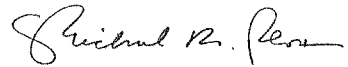
Moreover, the proposed rules will have a negligible impact on global carbon dioxide emissions, the reduction of which is President Obama's explicit goal motivating the creation of these rules. This is too much pain for very little gain.

Home to the highest concentration of manufacturing jobs in the nation, Indiana depends heavily on coal-burning power plants for reliable and affordable energy. More than 28,000 Hoosiers are employed in the coal industry. Those workers, along with Hoosier rate-payers, deserve better than this proposed regulation. The U.S. EPA proposal does not strike the proper balance to protect the health of the environment with the health of our economy and our position in the global marketplace. It will impede economic growth and prosperity at a time when we need to promote it.

I direct your attention to additional comments submitted jointly by agencies within my Administration. Their detailed comments identify a plethora of concerns with the

proposed rules, including policy, legal, and technical perspectives. These comments clearly show the dysfunction represented by the proposed rules and further substantiate the need to withdraw the proposal. I urge you to do so without delay.

Sincerely,

A handwritten signature in black ink, reading "Michael R. Pence". The signature is written in a cursive style with a large, stylized "M" and "P".

Michael R. Pence
Governor of Indiana



STATE OF INDIANA

Michael R. Pence, Governor



December 1, 2014

EPA Docket Center
 United States Environmental Protection Agency (U.S. EPA)
 Mail Code: 2822T
 Attention: Air Docket ID EPA-HQ-OAR-2013-0602
 1200 Pennsylvania Avenue, NW
 Washington, DC 20460

Dear Administrator McCarthy:

The State of Indiana via the undersigned agencies appreciates the opportunity to comment on the proposed rule entitled "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units" (EGUs) (June 18, 2014, 79 Fed. Reg. 34830). Indiana urges U.S. EPA to withdraw the proposed rule for multiple reasons.

While Indiana urges U.S. EPA to withdraw the proposed rule for multiple reasons as set forth below, the State of Indiana respectfully requests that U.S. EPA take into consideration the technical corrections and comments outlined in the attachments to this letter if it proceeds in finalizing the rule. These comments are the result of a thoughtful, collaborative process between multiple Indiana state agencies with expertise in environmental, utility and natural resource issues.

The U.S. EPA lacks the authority to regulate existing EGUs pursuant to Section 111(d) of the Clean Air Act (CAA). The U.S. Supreme Court has noted¹ that where a source category is regulated under Section 112 of the CAA, U.S. EPA may not employ Section 111(d) to further restrict emissions from those existing sources. Since existing EGUs are regulated under Section 112 of the CAA, the proposed rule exceeds U.S. EPA's statutory authority.

¹ *Am. Elec. Power Co. v. Connecticut*, 131 S. Ct. 2527, 2537, fn 7 (U.S. 2011).

In addition, U.S. EPA is relying on proposed regulations² that are not yet finalized as the predicate rules for new and modified EGUs. These rules are likely to be subject to legal challenges, and, if they are invalidated, any attempt to regulate existing EGUs under Section 111(d) of the CAA will further lack a statutory basis.

Furthermore, U.S. EPA does not have the authority under Section 111 of the CAA to require facilities to reduce emissions via action beyond the fence line and beyond the control of the affected sources. This proposed rule purports to implement control measures under the Best System of Emission Reductions (BSER) for Building Blocks 2, 3, and 4, but these measures are not under the direct control of the affected sources and are, therefore, not applicable under Section 111 of the CAA.

Granted, the proposed rule does not explicitly require that states implement any or all of the building blocks proposed by U.S. EPA. However, the manner in which U.S. EPA applied BSER to each building block to establish the goal for each state does require states to implement strategies beyond what can be achieved through a single building block. As a result, the statewide average emission rates proposed by U.S. EPA would be impossible to meet by implementing the only building block that can be legally implemented and enforced, that being Building Block 1. Clearly, the proposed rule is intended to regulate activities beyond the fence line and beyond the control of the affected sources. Federal law does not authorize this intent.

Indiana is in the process of developing a comprehensive energy plan. This plan is aimed at achieving the dual goals of long-term sustainability and cost-efficiency, while promoting economic vitality. The proposed rules are not consistent with our goals of affordable and reliable energy. Indiana is concerned that the proposed rules will lead to Hoosiers, particularly those in low income socioeconomic brackets, losing heat and power because they will not be able to pay for the rising utility costs. Indiana is also concerned that U.S. businesses will be unable to compete in a global economy due to the higher electricity rates, and that worldwide greenhouse gas emissions may actually increase due to the relocation of manufacturing operations from the U.S. to other countries with less restrictive regulations.

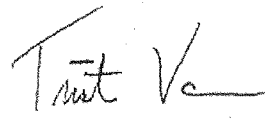
If you have any questions or need additional information, please contact Tom Easterly, Commissioner for the Indiana Department of Environmental Management, at (317) 232-8611.

² "Carbon Pollution Standards for Modified and Reconstructed Stationary Sources: Electric Utility Generating Units," (June 18, 2014, 79 Fed. Reg. 34960); "Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units" (January 8, 2014, 79 Fed. Reg. 1430).

Respectfully,



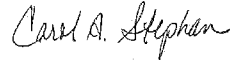
Thomas W. Easterly, *Commissioner*
Indiana Department of Environmental Management



Tristan Vance, *Director & Chief Energy Officer*
Indiana Office of Energy Development



A. David Stippler, *Utility Consumer Counselor*
Indiana Office of Utility Consumer Counselor



Carol A. Stephan, *Commission Chair*
Indiana Utility Regulatory Commission



Cameron F. Clark, *Executive Director*
Indiana Department of Natural Resources

Attachments:

- Attachment A – Technical Comments
- Attachment B – Indiana EGU Information – MWh
by Unit 2010-2012
- Attachment C – Indiana EGU Information – CO₂
Emissions by Unit 2010-2012
- Attachment D – Indiana EGU Information –
Nameplate Capacity

Attachment A – Technical Comments

Below are additional comments from the State of Indiana pertaining to specific elements of the proposed rule. The comments below represent areas where Indiana would like to:

- Provide updated or corrected information to U.S. EPA,
- Express concerns regarding technical understanding,
- Provide additional technical information for U.S. EPA's consideration, and
- Seek clarification concerning U.S. EPA's intent.

The comments contained in this Attachment should in no way be interpreted as a tacit acceptance of the legality or policy propriety of the proposed rules. As indicated in the cover letter to this Attachment, the State of Indiana believes the proposed rules should be withdrawn. If U.S. EPA insists on finalizing the rules, Indiana respectfully requests that the following be taken into account.

I. Time frames

- a. Indiana strongly feels that the 13 months U.S. EPA is allowing for state plan development is entirely insufficient for states to prepare adequate plans. Indiana's statutory rulemaking process requires a minimum of 1.5 years to fully promulgate a rule, and much longer for rulemakings that require extensive stakeholder involvement. Additionally, Indiana currently lacks the necessary statutory authority to implement and enforce Building Blocks 2, 3, or 4. Legislative action would be necessary for Indiana to contemplate the use of Building Blocks 2-4 in a state plan. U.S. EPA's proposed deadlines do not afford Indiana's legislature the time necessary to consider or act on the necessary authority considerations. The time frames, even with available extensions, are not long enough for the state to meet the requirements. The CAA generally provides states three full years to develop State Implementation Plans to address specific requirements of the Act. This proposal is far more complex than any State Implementation Plan developed by Indiana thus far. At a minimum, U.S. EPA should provide states five full years to prepare and submit a state plan under this requirement.
- b. State statutes and U.S. EPA's regulations in 40 CFR 60.24 allow states and U.S. EPA to set less stringent standards or longer compliance schedules for existing sources when warranted, considering cost of control, remaining useful life of the facilities, location or process design at

facilities making large scale and expensive changes to do so in a safe, reliable, and cost effective manner. Requiring facilities to make complicated and expensive changes within 3 years of the publishing of the rule puts the nation's electric grid reliability at risk.

- f. The transmission grid will need to be expanded to accommodate the increased generation and movement of renewable energy between and throughout states. The Regional Transmission Organizations' (RTOs') planning and the resulting construction processes currently take between five and ten years for grid expansion. With new transmission lines crossing multiple states and jurisdictions, issues involving route selection, cost allocation, and construction could lengthen this process even more. Under the proposed rule, interim compliance begins in 2020. The rule will leave insufficient time for any new transmission lines to be built to support compliance in the early 2020s. New lines would have to be energized in 2019 for compliance in 2020. That would be four years after the rule is finalized and only three years after compliance plans are to be submitted to U.S. EPA. There is simply not enough time to complete any new projects not already in the RTO planning process. Also, the RTOs use different calculation methodologies (e.g., for resource adequacy and transmission system capabilities) and capacity market constructs. These differences will have to be resolved to ensure effective regional compliance. Tariff changes will likely be needed, which will require approval from the Federal Energy Regulatory Commission (FERC). The resolution of these differences and changes will take a significant amount of time and more time than allotted for by the proposed rule.
- g. Indiana lacks the regulatory authority to implement and enforce a plan that relies on the use of all four building blocks, based upon which the state goal was established. The proposed time frames do not allow sufficient time for Indiana to seek legislative action in order to be able to implement this rule. Indiana has a part time legislature that meets from January through early spring. Indiana requests that the time frames for plan development and implementation of the rule be extended by a minimum of five full years.
- h. Indiana has not had adequate time to comment to U.S. EPA regarding the issue of converting a rate based goal to a mass based goal. This is a critical decision and Indiana is still in the process of evaluating the newly released guidance and will not be able to comment at this time. U.S. EPA has released numerous new technical documents during the comment

period, including the rate to mass guidance within 30 days of the end of the comment period, which normally would result in an extension of the comment deadline. With U.S. EPA not extending the deadline on this issue, they stand to lose important input from stakeholders. Furthermore, due process dictates that stakeholders have all information at their disposal with sufficient time to review, evaluate, and prepare comments. For this reason, the comment deadline should have been extended.

- i. By issuing a vaguely worded proposal that appears to provide large amounts of flexibility to states, U.S. EPA has created an opportunity for "gaming" the system. U.S. EPA has not provided detailed guidance on how to properly measure, document, and report compliance for any of the building blocks used in the BSER analysis. States are given flexibility to develop plans using undefined methods. There are multiple methods of quantification for nearly every measure that could be implemented under the building blocks that might be considered generally acceptable, each of which would likely derive very different results. If different states use different methods then one state could appear to have a substantially greater decrease in CO₂ emissions when they have not. This can lead to an unbalanced playing field with regard to cost of compliance and economic development. U.S. EPA needs to provide additional guidance and direction concerning complying with the rule to ensure that the rule is enforced equally from state to state and facility to facility. The time clock for states to develop state plans should not start until this final guidance has been released.

II. Reliability

- a. Indiana is very concerned with long term reliability issues associated with the electricity grid. Indiana advises U.S. EPA to consider the North American Reliability Corporation (NERC) 2014 Long-Term Reliability Assessment¹. The document states:

The electricity industry provided NERC with resource adequacy projections for the 2015–2024 assessment period. NERC independently assessed these projections and identified three key findings that will impact the long-term reliability of the North

¹ <http://www.nerc.com/news/Pages/Assessment-Identifies-Key-Long-Term-Reliability-Challenges.aspx>

American BPS and materially changed the way the system is planned and operated. These key findings are:

- 1. Reserve Margins in several Assessment Areas are trending downward, despite low load growth.*
- 2. Environmental regulations create uncertainty and require assessment.*
- 3. A changing resource mix requires new approaches for assessing reliability.*

The on-peak resource mix has recently shifted to be predominately gas fired: now 40 percent, compared to 28 percent just five years ago. This trend is expected to continue, as retiring coal, petroleum, nuclear, and other conventional generation is largely being replaced by gas-fired capacity and variable energy resources (VERs). The fundamental transformation of the resource mix—largely driven by environmental regulations, legislation, state and provincial incentives for additional VERs, and impacts of fuel prices, particularly for natural gas—presents new challenges for the electricity industry.

NERC also highlighted resource adequacy concerns, particularly in ERCOT, NPCC-New York, and MISO, as projections continued to reflect declining Anticipated Reserve Margins that fell below each area's Reference Margin Level during the short term (1-5 years).

The tightening of reserve margins increases the need to ensure all risks are accurately captured as policy and changing generation trends drive new potential risks to resource adequacy. New information projects an additional reserve margin shortfall in the North and Central Regions starting in 2016. Approximately 15% of coal capacity in the MISO footprint is projected to retire by 2016 to comply with the MATS. U.S. EPA's proposed CO₂ rule could place an additional 11 GW of coal capacity at risk of retirement in 2020.

By 2021, MISO's forecast is for reserve margins to fall from the NERC required 14.8% to 10.6% due to MATS. By 2020-2021, MISO estimates the reserve margins will drop to a negative 3.3% to comply with the additional requirements of CO₂ regulation. By 2023-2024, MISO's analysis shows reserve margins shrinking to negative 11.8%. In all cases,

these estimates are caveated by recognizing that currently unplanned resources are likely to be made available as a result of actions by state commissions and load-serving entities. As planning reserves erode the probability of loss of load and reliance on Emergency Operating Procedures increase exponentially.

- b. Indiana requests that U.S. EPA consider allowing states to adopt an emergency provision or "safety valve" that would allow carbon-intensive sources to operate beyond permitted emission limits in the event that grid reliability is compromised within a region. An example that could warrant a waiver of this type would involve extreme weather events that result in spikes in demand, such as the "Polar Vortex" experienced in the Midwest and East coast during winter of 2014. The cold weather not only increased electricity demand but also demand for natural gas. During the 2014 event, natural gas EGUs who had firm gas supply contracts did not receive the gas they expected because during periods of extreme demand, there was simply insufficient gas for these units to receive enough fuel to operate at high loads. Without natural gas units to provide reliable, base-load, lower-emitting CO₂ generation, electricity providers will have to rely on higher-emitting coal-fired units in this type of situation in the future. However, doing so could subject the company to prosecution under the CAA and could result in the company incurring millions of dollars in civil penalties, fines, and legal fees. Another example of this would be if a large nuclear unit must unexpectedly be taken offline, and there is no other reliable base-load generation other than coal in the area to replace the generation, then the state should be permitted to grant the coal unit a waiver so that it can operate to prevent regional reliability issues without incurring environmental liability for doing so. The proposed rule needs to take the concerns of grid reliability into account.
- c. Indiana has serious concerns regarding the reliability of gas supplies to EGUs and households for home heating purposes. If there is a large increase in the amount of natural gas used for electric generation within a very quick time frame, which this rule anticipates will happen, then not only could this cause serious volatility in the price of natural gas, it could raise reliability issues associated with availability and distribution. In the absence of adding expansive new natural gas pipeline capacity, the current infrastructure in Indiana is limited and may not be able to handle the increased demand for natural gas to both residential customers and EGUs. Unlike with coal, the ability to store natural gas onsite at the plant

is very limited, making interruptions to delivery service a very serious issue concerning grid reliability. Indiana is currently evaluating the infrastructure to determine the effect this rule will have on grid reliability. As a result of this rule, more and more EGUs are switching fuels to natural gas and this new demand has not been properly evaluated. A shortage of fuel capacity during cold Indiana winters could pose serious consequences for residential heating needs, as well as grid reliability. This would present a serious threat to public health and welfare for the citizens of Indiana.

III. Building Block 1: Heat Rate Improvements

- a. Indiana feels that U.S. EPA has severely underestimated the net economic impact of Building Block 1. Indiana does not have sufficient regulatory authority to implement any additional building blocks under the proposed rule, and as a result, would have to try to implement an even more stringent version of Building Block 1 in order to meet the CO₂ emission rate required by the proposed rule. This increased stringency on coal-fired units could result in the limiting of allowable hours of generation from coal-fired units and/or the operation of coal-fired units at a loss. This could also result in premature closure of coal-fired EGUs and stranded costs for Indiana ratepayers. Additionally, this scenario could have very serious adverse impacts on grid reliability. Indiana strongly recommends that U.S. EPA work with FERC prior to proceeding with the proposed rule to address the extraordinary effects of this proposed rule on electricity grid reliability.
- b. Indiana's generation portfolio is predominantly coal-fired; thus the 6% heat rate improvement applied by U.S. EPA drives a portion of the carbon emission reductions required for the state. While the data collection efforts of U.S. EPA are substantial, an important conclusion appears to lack justification. Page 2-28 of the Greenhouse Gas (GHG) Abatement Measures Technical Support Document (TSD) states that "if an EGU reduces heat rate variability, generally heat rate performance will improve." This conclusion appears to be supported by U.S. EPA's Figure 2-5 on the page following this statement. The regression analysis exaggerates this correlation because of the inclusion of what is clearly an

outlier. Removing the outlier from the data set² yields a best fit line defined by $y = 0.0009x - 3.7804$. The outlier's impact, at a minimum, warrants further investigation on the appropriateness of its inclusion. Absent a strong reason for inclusion, the outlier should be removed from the data set. While reduced heat rate variability would appear to be an attractive characteristic, the correlation of it to overall heat rate improvement is inappropriate.

- c. Indiana does not believe there is sufficient technical information available to show how the 6% heat rate improvement is achievable. U.S. EPA erroneously relied on the Sargent & Lundy³ report and incorrectly applied cumulative improvements in a manner inconsistent with how the study was conducted. The study was intended as a guide for EGU operators to use to evaluate potential areas for heat rate improvements. In the study, it was assumed many times that the technology being evaluated was older or had not already been already replaced with more up-to-date technology. However, many Indiana utilities have already implemented the suggested heat rate improvements and should be given credit in the proposed rule for those improvements.
- d. As part of its analysis to develop the 6% Building Block 1 heat rate reduction target, U.S. EPA relies on Continuous Emission Monitor (CEM) heat input and gross generation data from multiple specific generating units to determine what it believes are examples of significant step change improvements in gross heat rate. One of the generating units relied upon is Gibson Station Unit 1 in Gibson County Indiana, owned and operated by Duke Energy. U.S. EPA has erred in its reliance on the Gibson Unit 1 data because the CEM data for this unit is not independently representative for the analysis being conducted. First, prior to the spring of 2007, the Gibson Unit 1 flue gas exited a single common stack in combination with Gibson Unit 2. Per the CEM protocols of Part 75, heat input measurements from the single common stack were allocated to the individual units on a pro-rata basis using gross unit load. As a result, this CEM data does not independently represent the performance of Gibson Unit 1. Additionally, in the fall of 2007, Gibson Unit 1 was retrofitted with a new wet flue gas desulfurization system (FGD), including a new stack and completely new CEM system. It is inappropriate to compare CEM data

² The presented data set was approximated by visual interpretation and confirmed by replication of the presented best fit line.

³ Sargent & Lundy Study SL-009597 January 22, 2009

before and after this event as the U.S. EPA protocol allows up to a 7.5% Relative Accuracy Test Audit limit for the flow monitor, and 0.7% limit for the CO₂ monitor (the measurements from the flow monitor and the CO₂ monitor are used in the CEM heat input calculation). Therefore, any changes in heat rate cannot be differentiated between the change in the CEM itself and any actual gross heat rate improvement, if any. This is only further emphasized by the fact that the improvement being sought is within the established measurement accuracy of the instruments, and should therefore be completely discounted anyway. Lastly, when the selective catalytic reduction (SCR) (in 2005) and FGD (in 2007) were added, the auxiliary power consumption for the unit increased, also increasing the net heat rate, even while the gross heat rate remained constant. Since U.S. EPA's analysis is only relying on gross generation and heat input data, it does not capture the change in the true total net heat rate for which compliance with the Clean Power Plan is required. The Gibson facility is one of the largest coal-fired EGUs in the United States and critical to the establishment of BSER. Indiana strongly encourages U.S. EPA to revisit the methods used to establish BSER for Building Block 1 as this may not be the only instance where such an important technical oversight was made.

- e. Additionally, it is technologically impossible to apply all the improvements assumed under BSER and obtain the combined heat rate improvements outlined in the Sargent & Lundy study. For example, one of the technologies discussed are intelligent soot blowers. This technology could increase heat rate efficiencies by up to 1.5%, but on average would improve heat rates by 0.6%. Many facilities in Indiana already have intelligent soot blowers so there would be little improvement over the baseline, thus affecting the overall ability for facilities to achieve a heat rate improvement of 6% as established by BSER.
- f. Furthermore, the reductions observed in the Sargent & Lundy case study were done on a facility operating at full capacity, thus giving maximum opportunity for any upgrades in equipment to be observed. It is very important to note that the heat rate improvements for the facility even with replacing outdated equipment at full capacity were only 4%. This is substantially lower than the 6% established by U.S. EPA. When facilities operate at less than maximum capacity, the heat rate improvements will not be as pronounced as they were observed in the Sargent & Lundy case studies. It is also important for U.S. EPA to factor in that Building Block 2

of the proposed rule would cause coal units to operate at less than the designed capacity and, thus have higher heat rates than they would at normal operating conditions.

- g. Indiana requests that U.S. EPA consider the follow-up release by Sargent & Lundy⁴. In this paper, Sargent & Lundy provide summary comments regarding the study used by U.S. EPA in the proposed rule and are clear that the 6% heat rate improvements are in fact not attainable.
- h. Indiana power plant operators are required to comply with a wide range of environmental requirements. Many commercial solutions employed to meet these requirements have a negative impact on the plant's net heat rate. Flue-gas desulfurization equipment, in particular, can degrade heat rate because they place significant auxiliary load on a plant.⁵ Several Indiana plants have or will have added these significant power demands after the 2012 emissions base year (e.g., Ohio Valley Electric Corporation's 6 units at Clifty Creek and 2 units at NIPSCO's Schahfer station). The addition of these environmental compliance devices, among other devices with varying heat rate penalties, will exacerbate what were already unattainable heat rate improvement aspirations. The failure to explicitly recognize this real-world circumstance in the development of the goal by U.S. EPA suggests that it has been unreasonably discounted and in effect penalizes a state that is undertaking reasonable steps to meet other environmental mandates.
- i. Many facilities in Indiana have already applied most of the basic improvements (low-hanging fruit) as outlined in the study. In conversations with utilities and the Indiana Utility Regulatory Commission (IURC) and the Indiana Office of Utility Consumer Counselor (OUCC), combined with the reported equipment improvements at EGUs, Indiana concludes that facilities under ideal conditions can only obtain 1-3% (less under reduced capacity usage or increased cycling) improvement in heat rates, depending on the facility and how many heat rate improvements they have already implemented prior to the release of the proposed rule. Given the nature of how the heat rate improvements are applied in the

⁴ Appendix A – Letter from Raj Gaikwad Ph.D VP Sargent & Lundy to Mr Rae Cronmiller National Rural Electric Cooperative Association

⁵ Heat rate penalty of 1.5% to 1.8% presented in Table 5-3 for Illustrative LSFO type scrubbers in U.S. EPA Base Case v 5.13 power sector modeling (www.epa.gov/powersectormodeling/docs/v513/Chapter_5/pdf).

proposed rule, EGUs do not get credit for the improvements made prior to 2012 and would still need to meet the 6% heat rate improvements to comply with the application of BSER for Building Block 1. The final rule should account for these variations in available heat rate improvements.

- j. While U.S. EPA has relied on specific data regarding the CO₂ emissions, generation, and heat rates reported by EGUs through the Clean Air Markets Database to determine the overall efficiency potential of heat rate improvement (HRI) projects for existing units, U.S. EPA assumptions from this data are too broad and do not take into account unit-specific designs. Before U.S. EPA sets an efficiency goal for coal-fired units under Building Block 1 or state CO₂ targets, Indiana recommends U.S. EPA issue an information collection request (ICR) to all fossil-fuel fired EGUs and Load Serving Entities (LSEs), or electric utilities, to determine the following:
- What HRI projects each coal-fired EGU has already installed.
 - The date of any such HRI installations.
 - Any operation and maintenance measures each coal-fired EGU already employs that assist the unit in operating more efficiently.
 - If the coal-fired EGU uses some of its fuel to supply steam to other customers.
 - If the coal-fired EGU is owned by a regulated utility, then the expected retirement year of the unit according to the utility's last approved depreciation study.
 - If a coal-fired EGU is owned by a merchant power producer or an unregulated utility, the planned date for the next major unit overhaul for the purpose of determining an appropriate retirement date.
 - For load-serving entities (LSEs), or electric utilities, the generation source, type, and location.
 - Capacity of generating units.
 - Power supplied through purchased power agreements in 2012 (or any historical years eventually used as a baseline for setting CO₂ targets).
 - Renewable Energy Credits (REC) inventories as of December 31, 2012 (or as of the end of any historical years used in the baseline for setting CO₂ targets).

Indiana believes this information is crucial for U.S. EPA to know and consider, as it will provide the agency with specific heat rate improvements already conducted at EGUs and their expected retirement

dates. Indiana notes that U.S. EPA has issued ICRs in past rulemakings to determine a reasonable and achievable emission limit that is technically and economically attainable for sources within a particular source category. Indiana recognizes that such a request will take time to execute and analyze the data, but such an endeavor is necessary to determine a realistic efficiency improvement goal for existing coal-fired EGUs and appropriate generation targets in each state.

- k. Indiana asks U.S. EPA to clarify which method(s) states are to use to quantify and document the reduction in heat rates. If U.S. EPA is expecting that states use CEMs to monitor BTU/KWh, this expectation should be clearly stated within the rule. U.S. EPA should also take notice that under Part 75 (the Acid Rain Program); the accuracy reading for flow monitor is +/- 7.5%. With the variability of accuracy of the monitor being greater than the expected increased efficiency there could be technical issues demonstrating compliance.
- l. Fuel switching should not be considered an acceptable method for achieving heat rate improvements. Technically speaking, changing from coal to natural gas fuel would actually raise heat rates. While the amount of CO₂ would decrease from a unit that switched to natural gas fuel, this is due to the amount of CO₂ released from the fuel and not due to an improvement in heat rates. Also, fuel switching may trigger New Source Review (NSR).
- m. Given the time frame associated with the rule, it is important to note that heat rate improvements degrade in effectiveness over time and it is unlikely that facilities can maintain a fixed heat rate improvement for a 10 year period. Indiana requests that U.S. EPA consider revising the way that Building Block 1 is calculated over time to take into account the unavoidable degradation in heat rates even after all improvements are implemented.

IV. Building Block 2: Redispatch

- a. Indiana is concerned that the implementation of Building Block 1 and Building Block 2 will work against each other. Under the proposed rule, U.S. EPA dictates that natural gas units operate more as base load suppliers and coal units will operate more as peak demand units, also

called “peakers”. Coal units operate more efficiently as base load units than they do as peaker units. If coal units are required to constantly change energy output then the units will be operating at less than peak efficiency and will not be able to obtain measurable heat rate improvements.

- b. Indiana strongly suggests that U.S. EPA consult with FERC before trying to redefine the entirety of the electric market/dispatch. U.S. EPA is looking to complete and implement this rulemaking in a very short period of time. This is occurring at a time that EGUs are instituting control plans for other federal rulemakings. The electricity market can be volatile, and massive changes in the capacity and distribution of electricity could have major implications on the market. By incorporating FERC into the rule development process, U.S. EPA will have a better technical understanding of the important subtleties associated with electricity dispatch and appropriate timeframes for changes to occur.
- c. Indiana is concerned that not all NGCC plants will be able to operate at a 70% capacity factor as proposed by the application of BSER under Building Block 2. Based on consultation with electric utilities in Indiana and surrounding states that run NGCCs, there is concern whether older facilities will be able to run at 70% capacity factor due to the age of the equipment and the required maintenance. Some NGCCs have been built using equipment from older coal units and as a result are not as efficient as newer units.
- d. Indiana believes that U.S. EPA's assumption that NGCC plants are capable of operating at a 70% capacity factor overestimates capabilities of Indiana's NGCCs. In the year 2012, natural gas prices were at record lows⁶. Natural gas powered EGUs were able to sell power to RTOs at lower prices than coal-fired EGUs and had a larger piece of the power sector. It was also a very hot summer in Indiana⁷, and energy usage was above normal levels. Even under these conditions, in which there was a financial advantage to maximize natural gas power, NGCC capacity usage in Indiana was only at 53% when averaged between all the NGCC units. This indicates that BSER for Indiana NGCCs should be closer to 53% than

⁶ U.S. Energy Information Association - <http://www.eia.gov/dnav/ng/hist/ngwhhdm.htm>

⁷ National Weather Service – NOAA - <http://www.crh.noaa.gov/ind/?n=localcli>

70%. The Noblesville⁸ facility is a former coal-fired unit converted to a NGCC unit by the addition of combustion turbines, and is less efficient.⁹ The Noblesville unit ran at a 29% capacity factor in 2012, despite the favorable natural gas price conditions of that period. While new NGCCs built in Indiana would most likely be able to operate at a 70% capacity factor and help Indiana reach the BSER determination, this would require Indiana to bring all new NGCC units in under both Section 111(b) and 111(d) to be able to meet the BSER. It is unclear whether a facility can be regulated under both elements of Section 111 and it most certainly was not the intention of the CAA to force states to build new facilities in order to meet BSER requirements under 111(d).

- e. Requiring NGCC EGUs to operate at a 70% capacity factor could create an enormous economic disadvantage to ratepayers. The situation could be very problematic if natural gas prices increase sharply because the cost to operate a NGCC would also increase. Such units would have to bid into a wholesale RTO market at zero cost (sometimes called a "must run" unit) in order to ensure that they are dispatched by the RTO at a 70% capacity factor. In a traditionally-regulated state like Indiana, the actual costs to operate the NGCC unit would be paid for by ratepayers. Therefore the ratepayers would be paying higher costs for this energy rather than being able to obtain cheaper energy in the wholesale market.
- f. U.S. EPA used nominal nameplate capacity when determining the capacity for EGUs in this proposed rule. Indiana believes summer peaking values should be used, as they are a much more accurate measure of an EGU's capacity.
- g. U.S. EPA needs to be conscious of any possible constraints regarding dispatch of less CO₂ emitting units. Under Building Block 2 RTOs would be expected to dispatch the lower CO₂ intensive energy first. This could result in facilities that produce energy at a lower CO₂ rate being called on to dispatch more frequently than in the past and as a result exceed limits that could trigger NSR.
- h. Indiana is concerned that U.S. EPA has not properly taken into account the costs associated with the increase of natural gas usage. While U.S.

⁸ Noblesville is a 1950s-era coal-fired plant that was converted in 2003.

⁹ 2012 FERC Form 1 reported net heat rate of 8520 Btu/kWh.

EPA estimated a modest increase in natural gas costs, an increase in delivery costs was not factored in. In some states, the delivery cost makes up more than half the costs for the fuel.

- i. Indiana is assuming that when a new NGCC unit goes online after 2016-2017, that unit will be subject to 111(b) and not subject to 111(d). Through conversations with U.S. EPA staff, it has been conveyed that states will have the option to include new NGCC units into the 111(d) planning process, thus making them subject to 111(d) standards. In order to prepare a compliant state plan, Indiana needs to see this matter explicitly addressed in the rule, including how states can avoid legal pitfalls associated with regulating affected entities under both elements of Section 111 (new and existing).
- j. Indiana urges U.S. EPA to consider allowing states to obtain credit towards the determination of the state rate goal when purchasing power from NGCCs from another state. This would be similar in implementation as proposed in Building Block 3 for renewable energy.
- k. The implementation of this building block is challenging for a state to implement on its own. In the Midwest, electricity is dispatched by RTOs, not individual states or power companies. **Indiana does not have regulatory authority to control the dispatch of electricity within its own borders, let alone on a regional basis, and thus lacks the authority to implement Building Block 2.** Even if the state were to establish the authority to mandate dispatch of electricity from NGCCs at a certain level of capacity, implementation would have to be conducted by an RTO, not the state. Therefore, Indiana would not be in a position to properly oversee and enforce implementation, or ensure adequate recordkeeping.
- l. The only manner in which EGUs have the ability to influence the dispatch of electricity revolves around the price at which the electricity is bid for dispatch. EGUs may have to bid on natural gas electric generation at a loss to ensure that the RTO dispatches it over coal in order to ensure a 70% utilization rate. This will create a much larger economic impact on the ratepayers and utilities than is currently used in costing information by U.S. EPA in the proposed rule.
- m. Indiana is concerned about the prospect of our nation becoming too reliant on a single source of fuel (i.e. natural gas) to supply the majority of its

energy generation. A nation highly dependent on one resource becomes a nation overly protective of a critical chokepoint and the economic, political, and societal implications of that dependency. Natural gas has a long history of price volatility. To the extent our nation becomes more dependent on natural gas, the short, medium, and long term vulnerabilities of natural gas resources must be realistically examined from the perspective of the electric industry, the nation, emerging international markets for liquefied natural gas exports, and, most importantly, the consumer. In its apparent determination to wean the country off coal, through this and other rulemakings, U.S. EPA could transition the country to a natural resource even more vulnerable to disrupting vast segments of the nation and the economy. U.S. EPA should re-consider its rule to recognize the value of a more robust and varied fleet of fuel resources throughout the country, taking full advantage of each state's relative ability to take advantage of the resources readily available to it. Thoughtfully employed fossil fuel resources will remain an important part of our nation's energy mix as part of an "all of the above" strategy, even as they are supplemented by increasing levels of nuclear and/or naturally replenishing resources in locations where they are more abundant (e.g. solar, geothermal, hydraulic, tidal, wind, etc. each have areas where they are most practical).

V. Building Block 3: Renewable Energy

- a. Indiana recommends that U.S. EPA reconsider the methodology used to calculate renewable energy (RE) targets for states under Building Block 3. When calculating RE potential, U.S. EPA relied in part on a regional RE growth factor calculated using the Renewable Portfolio Standards (RPS) of states within that region, which was then applied to each state in that region, whether that state had an RPS in place or not. This has the potential to make renewable energy targets very aggressive in some states that have less RE potential, as well as no enforceability, and could result in unattainable renewable energy targets in those states. For instance, in the proposed rule, Indiana is a member of the North Central region, along with eight other states in the upper Midwest. Of these nine states, three (Indiana, North Dakota, and South Dakota) have non-binding renewable portfolio goals, while the rest have binding RPS. Therefore, the regional growth rate applied to Indiana was largely based on the renewable potential of other states. Further, within the North Central region, states like North Dakota, South Dakota, and Minnesota have

substantially larger wind speed potential than Indiana, as shown in the National Renewable Energy Laboratory's (NREL) Annual Average Wind Speed map, yet these states are still grouped together in the same region for RE potential. However, the RE potential from wind speed is very different. At 80 meters high, around half of Indiana has an annual average wind speed of 6.5 meters per second (m/s), whereas the majority of areas within both North and South Dakota show an annual average wind speed of 8.5 m/s¹⁰. Because these states are grouped together for part of the RE calculation, it results in a higher calculated RE target for Indiana than is actually achievable, which in turn makes the state CO₂/MWhr goal rate lower than what is actually achievable. Further, each state with an RPS in place defines elements within their programs very differently. According to the Energy Information Administration's (EIA) Annual Energy Outlook 2013, "Under [RPS], each state determines its own levels of renewable generation, eligible technologies, and noncompliance penalties¹¹." Therefore, using a regional approach, without taking into account the considerations detailed above that relies in part on an average of RPS goals within those regions in order to calculate RE targets for states, is unreasonable and untenable.

State Renewable Energy (RE) Generation Levels for State Goal Development as they exist in the proposed rule are as follows:

State	2012 (Percent)	Proposed Goals		Alternate Goals	
		Interim Level (Percent)	Final Level (Percent)	Interim Level (Percent)	Final Level (Percent)
Illinois	4	7	9	6	7
Indiana	3	5	7	4	5
Iowa	25	15	15	15	15
Michigan	3	6	7	5	6
Minnesota	18	15	15	15	15
Missouri	1	2	3	6	2
North Dakota	15	15	15	15	15
South Dakota	24	15	15	15	15
Wisconsin	5	8	11	7	8

¹⁰ National Renewable Energy Laboratory, <http://www.nrel.gov/gis/wind.html>

¹¹ Energy Information Administration, [http://www.eia.gov/forecasts/aeo/pdf/0383\(2013\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383(2013).pdf)

U.S. EPA's North Central grouping regard to geography and renewable energy potential can be classified as unusual at best. States such as Minnesota, North Dakota, and South Dakota have vast potential for wind energy development while mid-western states such as Indiana, Illinois and Michigan have limited potential for the same resource. To compare Indiana to the Dakotas would require the Dakotas to limit the value of their potential or make potentially unrealistic demands on Indiana. Unlike most of the other states in U.S. EPA's North Central grouping, Indiana's economy relies heavily on energy-intensive heavy industry which requires low energy costs and reliable power sources to survive. Examining the RPS standards for the states contained in U.S. EPA's North Central grouping does not provide a reasonable basis for logical comparison. Over 44% of the states contained in U.S. EPA's North Central grouping will have an RPS which expires in 2015 and one state has a megawatt goal rather than an RPS. The remaining 44% of the states have RPS targets which extend into 2025 (except Missouri, which expires in 2021). Also, those states which have RPS targets expiring in 2015 have target goals of 10%, while the states with RPS goals extending beyond 2020 have RPS goals between 15% and 25% (except Indiana which has set a voluntary goal of 10%).

State	RPS Goal (%)	RPS Goal (MW)	Target Date
Illinois	25		2025
Indiana	10		2025
Iowa		105	
Michigan	10	1,100	2015
Minnesota	25		2025
Missouri	15		2021
North Dakota	10		2015
South Dakota	10		2015
Wisconsin	10		2015

Should the EPA move forward with this rulemaking, to create a more equitable and appropriate evaluation of regional renewable potential and allow for the establishment of realistic regional goals, the EPA must re-evaluate the existing groups as they now stand and re-align them.

- b. How will U.S. EPA account for long-term wind variability, such as that noted in the NREL Technical Report NREL/TP-5500-53637¹²? The level of wind generation varies with the amount of wind over the course of a year and the amount of wind across a region can vary from year to year. Will states be considered compliant if their actual renewable generation is within some percent (for example plus/minus 5%) of their state goal?
- c. If U.S. EPA keeps building block 3, Indiana prefers the incorporation of an alternative RE calculation that relies on a state-by-state evaluation which considers each state's capacity for various types of RE measures. A state-by-state approach, rather than a calculation that focuses on regional goals which may overestimate RE capacity in some states, would ensure that RE targets are more tailored to each state's unique circumstances. However, Indiana insists that state RE goals must be both attainable and realistic, both from a capacity and cost-effectiveness standpoint. Indiana does not support the RE approach suggested in U.S. EPA's Alternative RE Approach TSD. The calculation used in the alternative RE approach measures technical potential by using the NREL database, which doesn't take into account important variables like cost or grid limitations. Further, this calculation includes a benchmark calculation based on the top third of states in a given type of renewable electricity. This is problematic because it may lead to unrealistic and unachievable RE goals. In Indiana's case, the alternative RE calculation sets a goal of 19% RE by 2025 and 2030, which is highly unlikely. The BSER calculation for Building Block 3 has a final goal of 7% RE by 2030. The final goal in the alternative RE approach is more than twice the RE number in the original calculation. Indiana does not believe this goal is at all realistic, especially since Indiana currently has no way to mandate RE measures. Further, due to the timing of the proposed rule and proposed date for state plan submittal, Indiana does not have the time to pursue legislative action in order to obtain proper authority to implement this Building Block. Indiana would prefer an alternative RE calculation that specifically focuses on each state's unique characteristics, rather than one that includes benchmarks or calculations based off of regional characteristics, to be incorporated into the state rate.
- d. Indiana recommends that U.S. EPA include hydroelectric power in its baseline and future state goal calculations. Excluding hydropower does

¹² <http://www.nrel.gov/docs/fy12osti/53637.pdf>

not encourage utilities to continue to invest in the maintenance and upkeep of existing units. Also, it does not encourage states or utilities to invest in potential new hydropower capacity. Indiana has five hydropower plants that have the capacity for roughly 73.2 megawatts (MWs) of electric generation, according to the EIA¹³, and these plants are currently not included in Indiana's state goal calculations. According to the National Hydropower Association, by 2025, the U.S. has the potential to install around 60,000 MW of new hydropower capacity¹⁴. Further, according to the EIA, Indiana produced around 34% more electric generation from hydropower in July 2014 than in July 2013, meaning there's an uptick in avoided CO₂ emissions that the state should get credit for in the goal calculation¹⁵. If U.S. EPA intends to encourage the use of renewable energy through this proposed rule, they need to promote the use of all types of renewable energy, not just certain ones. Indiana recognizes that U.S. EPA has not ruled out the option for states to include incremental hydropower generation from existing facilities or later-built facilities and encourages U.S. EPA to include hydropower generation in any revised goal calculations.

- e. The proposed rule does not address the development, availability, and use of innovative state-of-the-art hydroelectric generation technologies within state plans. As an example, micro-hydroelectric generation technology has matured to the point where Portland, Oregon is installing in-pipe turbines capable of producing 1,100 megawatt hours of electricity a year – enough to power up to 150 homes. The proposed rule provides no incentive for the development of this environmentally safe, effective, and efficient technology which could be deployed within every municipality in the United States which operates a water utility. By creating this type of incentive, a deployment of this type of technology on a large scale would create significant economic initiatives, while upgrading water supply systems and providing incentives for academia and industry R&D efforts to develop even more efficient and effective micro-hydroelectric generation systems.
- f. Indiana requests that U.S. EPA provide guidance as to what specifically would qualify as "permanent and enforceable," especially with regard to

¹³ Energy Information Administration, <http://www.eia.gov/state/?sid=IN>

¹⁴ National Hydropower Association, <http://www.hydro.org/tech-and-policy/faq/#723>

¹⁵ Energy Information Administration, http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_13_a

Building Blocks 3 and 4, which focus on the quantification of renewable energy and energy efficiency measures. Indiana does not have a mandated RPS in place but does have a non-binding goal¹⁶. The compliance timetable for plan development and implementation of this rule might not allow Indiana to pursue a RPS; therefore, the state may not have the mechanisms in place in order to properly enforce Building Blocks 3 and 4. More guidance with regard to what constitutes enforceability is crucial in order for Indiana to consider incorporating these building blocks into a state plan.

- g. Indiana believes U.S. EPA should consider further promoting the incorporation of other types of renewable energy into Building Block 3, including hydropower, biomass, coal bed methane, and landfill methane. Digesters at confined feeding operations, as well as municipal waste treatment facilities, would produce energy by burning methane gas. Methane gas has a global warming potential over 20 times more potent than CO₂, according to U.S. EPA¹⁷. Therefore, if utilities are allowed to get credit for burning methane gas for energy, they not only gain the benefits of generating electricity, but the CO₂ equivalent produced is less than if they were to rely on coal for the same electricity being produced and the previously uncontrolled methane emissions are also eliminated. If the intent of this rule is to reduce greenhouse gas emissions then the use of methane to produce energy should not only be included, but it should also be incentivized with greater weight when calculated toward state goals compared to other fossil fuels and renewable energy.
- h. Indiana would like clarification in any revised rule regarding waste to energy (WTE). Indiana interprets that each megawatt hour or steam equivalent generated by a WTE facility shall be measured as one megawatt hour of compliance toward the carbon intensity reduction requirements. Indiana law, along with Federal statutes and policies, recognize all of the energy generated from WTE as renewable. Indiana is not unique in this regard: every state which includes WTE in their renewable program similarly recognizes all of the energy these facilities generate as renewable. U.S. EPA should eliminate the ambiguity created in a technical document and specifically clarify that states desiring to

¹⁶DSIRE Indiana, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IN12R

¹⁷ U.S. EPA, <http://www.epa.gov/climatechange/ghgemissions/gases/ch4.html>

recognize the energy generation from waste-to-energy be fully measured as compliance.

- i. In order for Indiana to meet the renewable goal set by U.S. EPA in Building Block 3, the state would essentially have to double its wind farm capacity. However, current infrastructure does not allow all of the energy currently being produced by Indiana's wind farms to reach the grid, so additional wind energy capacity still would not increase Indiana's renewable energy share. Until new transmission capacity is in place, it is impossible for wind energy production to increase. Transmission lines are being scheduled for installation by the Midcontinent Independent System Operator (MISO) in the coming years to address the current problem¹⁸, but the interim time frame for this rule does not give sufficient time for adequate infrastructure to be put in place. Based on the factors described above, Indiana is not in a position to adequately address the goal proposed by U.S. EPA for Building Block 3 within the proposed rule's timelines.
- j. The RE goal for Indiana of 7,547,087 MWh (approximately 7% of total generation of 121,794,969 MWh) will be difficult to achieve. Indiana has a Voluntary Clean Energy Portfolio Standard (VCEPS) Program. None of the Indiana utilities have developed renewable generation using the VCEPS Program. Additional legislative action in Indiana will be required to achieve state compliance with the Clean Power Plan's RE goal, which could take a considerable amount of time to implement.

VI. Building Block 4: Energy Efficiency

- a. Indiana is very concerned with the application of BSER under Building Block 4 of the proposed rule. In 2012, the year that U.S. EPA chose to garner data from, Indiana had a state-mandated energy efficiency program in place called Energizing Indiana¹⁹. However, the Indiana General Assembly passed legislation which brings the program to an end as of December 31, 2014, meaning Indiana will no longer have a state-mandated energy efficiency program. Because of this, Indiana no longer has any regulatory authority to mandate any type of demand-side energy

¹⁸ Midcontinent Independent System Operator, <https://www.misoenergy.org/Planning/TransmissionExpansionPlanning/Pages/TransmissionExpansionPlanning.aspx>

¹⁹ Energizing Indiana, <https://energizingindiana.com/>

efficiency measures. Therefore, even though many utilities have decided to continue the program voluntarily, Indiana is uncertain how the state would receive credit in the state plan for reduced energy use for voluntary measures that the state has no control over. Even if the state legislature were to approve a new state-mandated energy efficiency program in the 2015 legislative session, Indiana would not have sufficient time to implement the program before state plan submissions would be due. Due to the proposed timeline and uncertainty of enforceability under Building Block 4, the state goal calculation may be unrealistic, and Indiana may not be able to rely on this building block at all in the state plan.

- b. On pages 5-23 and 5-24 of the GHG Abatement Measures TSD U.S. EPA cites several studies²⁰ of achievable EE/DSM. But the U.S. EPA selected the most optimistic values rather than an average of the different analysis that would give appropriate effect to the credibility of all of the analysis. As U.S. EPA correctly noted, EE/DSM has been evolving; past experience may not prove to be an accurate predictor of future results. Thus, achieving a 1.5% annual increase in EE/DSM is suspect.
- c. Independent analysis raise further questions as to the cost effectiveness of energy efficiency in the region. Preliminary MISO regional modeling results show that the model did not choose energy efficiency (even assuming U.S. EPA's EE costs which are lower than Indiana's actual EE costs) when the model was allowed to optimize CO₂ reduction options at

²⁰ On a normalized basis, the EPRI 2009 study provides an achievable annualized potential range of 0.2-0.4% per year (realistically achievable and maximum achievable potential, respectively) through 2030 at the national level. Two more recent studies also provide national estimates of achievable EE potential: EPRI (2014) updates their 2009 analysis, using a conventional bottom-up engineering approach, and ACEEE (2014), using a top-down, policy-based approach derived from state experience and their evaluated results. EPRI (2014) results show an average annual achievable potential range of 0.5% to 0.6% per year (achievable and high achievable potential, respectively). ACEEE found average annual achievable potential of 1.5% per year.

At the regional and state level, two meta-analyses, Sreedharan (2013) and Eldridge et al. (2008), captured numerous studies conducted between 2001 and 2009. The meta-analysis conducted by Sreedharan (2013) presents average annual values of 4.1% per year in technical potential, 2.7% per year in economic potential, and 1.2% per year in maximum achievable potential. In comparison, Eldridge et al. (2008) estimated average annual values of 2.3% per year in technical potential, 1.8% per year in economic potential, and 1.5% per year in achievable potential. To supplement these studies with more recent data, the EPA has conducted a meta-analysis of twelve studies conducted between 2010 and 2014 at the utility, state or regional level (see Appendix 5-1). The EPA review indicates an average annual achievable potential of 1.5% per year across the reviewed studies. See Appendix 5-2 (Summary of Recent (2010-2014) – Emphasis added.

the least cost. Energy efficiency is a large part of U.S. EPA's assumed building blocks for Indiana. However, energy efficiency does not appear to be part of the least cost solution to meet CO₂ goals for Indiana.²¹

- d. U.S. EPA requested comment on a potential increase in annual incremental savings from 1.5% to 2% per year, as well as a pace of improvement from 0.2% to 0.25% per year. Indiana does not support increases to either of these two categories. Indiana questions the practicality and cost effectiveness of these increases as costs rise sharply as more EE measures are put into place. Further, as mentioned above, Indiana currently does not have the regulatory authority to require any type of energy efficiency program and the timing of this rule makes it impossible to get such authority in place by the proposed date of plan submittal. Indiana is uncertain as to how to include this building block in its state plan in the first place and therefore would not support an increase in the annual incremental savings percentage or pace of improvement calculation.
- e. With regard to calculating EE for Building Block 4, Indiana requests that U.S. EPA provide a more detailed explanation of its calculations. Some states calculate energy efficiencies differently than others and in order for each state to get equal credit for various energy efficiency measures; a standard methodology needs to be set by U.S. EPA. For instance, the same LED light bulb replacement is credited differently under Michigan's RPS than under Indiana's renewable portfolio goal. U.S. EPA should release a standard for calculating various energy efficiencies prior to the implementation of the rule in order to ensure that each measure is calculated in a fair and consistent manner. Indiana also requests that U.S. EPA provide detailed spreadsheets that contain formulas, rather than hard numbers, in order for states to have the opportunity to understand just how the EE calculations would work going forward, particularly for the calculations used in Building Blocks 3 and 4.
- f. Indiana also requests examples of what would qualify as evaluation, measurement, and verification (EM&V) under both Building Blocks 3 and 4. Since Indiana will no longer have a state-mandated energy efficiency

²¹ MISO GHG Regulation Impact Analysis – Initial Study Results September 17, 2014 (<https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/PAC/2014/20140917/20140917%20PAC%20Item%2002%20GHG%20Regulation%20Impact%20Analysis%20-%20Study%20Results.pdf>)

program at the close of 2014, nor does the state have an RPS currently in place, Indiana is unsure what would constitute suitable EM&V if these building blocks are incorporated into the state plan. Due to the proposed timeline of the rule, Indiana would not be able to get legislative authority in place to be able to implement or enforce renewable energy or energy efficiency programs before the state plan is due, so it is unclear how Indiana would be able to rely on either Building Blocks 3 or 4 in the state plan.

- g. U.S. EPA's energy efficiency cost estimates of \$0.09/KWh are much lower than Indiana's derived cost estimates. An independent study done by National Economic Research Associates (NERA) suggests that, based on a review of historical energy efficiency costs, a national levelized cost of \$0.10/KWh is a more accurate assumption²². Indiana's costs are even higher. Based on the Indiana utilities' 2015 DSM/EE plans, the costs to utilities range from \$0.11 to \$0.16/KWh. However, the Indiana Office of Utility Consumer Counselor (OUCC) points out that costs to ratepayers are even higher, as Indiana's inclusion of lost margins and shareholder incentives more than doubled Indiana's DSM/EE costs to an average of \$0.32/KWh. If these compliance costs are taken into account into 111(d), this could have an impact on the BSEER analysis for this building block, as well as make this option less affordable for states to implement and, in turn, for consumers, who would bear the brunt of such an increase through an increase in utility rates. Indiana recommends that U.S. EPA consider all available costing information in order to provide stakeholders with more reliable cost estimates.
- h. Indiana seeks clarification of how states that undertake investments between 2012-2020 will be assured they will be fairly credited. For 2012-2017, is U.S. EPA only referring to the lifetime of the measures being reflected in the cumulative savings figures or is there something more? As stated previously, Indiana believes most of the "low-hanging fruit" will be captured in the earlier years and achievement in subsequent years will be more difficult and expensive, barring unforeseen changes in technology or other factors that affect cost-effectiveness. Please detail how these pre-2020 improvements in EE savings will benefit a state in meeting its EE goals in 2020 and beyond. One reasonable interpretation of the proposed

²² National Economic Research Associates,
http://www.nera.com/content/dam/nera/publications/2014/NERA_ACCCE_CPP_Report_Final_1014.pdf

rule would suggest that states might be better off postponing aggressive EE/DSM until 2020 to get maximum value. We doubt this was U.S. EPA's intent, but clarification is needed.

- i. U.S. EPA acknowledges demand response, or peak shaving, within the proposed rule as an element of some states' energy efficiency resource standards (EERS), but also characterizes Building Block 4 as largely 'end-use' energy efficiency. Indiana believes that credit for reductions under Building Block 4 should be given for measures such as demand response, which reduces or shifts electricity usage during peak periods and is typically utilized by electric system operators in order to produce energy at a more efficient rate. This not only saves consumers money, but it also results in overall reduction of CO₂ emissions. FERC 2009 National Assessment of Demand Response Potential developed four potential scenarios to reflect various levels of demand response within the nation over a ten year period from 2009 to 2019²³. They found that demand response has the potential to reduce peak electricity demand by as much as 20% by 2019 if fully utilized under the Full Participation scenario. Even under the Expanded Business-As-Usual scenario, which expands current demand response programs to all states, utilizes a partial deployment of advanced metering infrastructure, and ensures that a small percentage of ratepayers would make use of dynamic pricing, peak electricity demand is reduced by 9% over the ten year period (2009-2019). If demand response programs are largely expanded and encouraged across the country, a large amount of peak electricity demand could be saved, resulting in a large amount of avoided CO₂ emissions. U.S. EPA should encourage the use of demand response by incorporating it in the energy efficiency calculations of Building Block 4 since it has the potential to cut CO₂ emissions, in addition to saving money for ratepayers.
- j. A state should receive the full credit for demand-side energy efficiency programs, regardless if it is a net importer of electricity. A reduction in generation is a reduction in generation, whether or not the generation occurs within a state's borders. To make such adjustments for states that are already having in-state supply issues would only discourage DSM adoption and serve as further disincentive to the importing states that need to implement DSM/EE programs the most. Moreover, if energy efficiency costs are paid for by "out of state" ratepayers, the 111(d)

²³ Federal Energy Regulatory Commission, <http://www.ferc.gov/legal/staff-reports/06-09-demand-response.pdf>

benefits of energy efficiency should be credited to the state that is paying for the efficiency improvements.

- k. Indiana believes that U.S. EPA should consider allowing states to include other types of energy efficiency measures within their state plans. For instance, Indiana has taken steps to reduce the amount of energy used by water and wastewater utilities. Energy consumption by public drinking water and wastewater utilities, which are primarily owned and operated by local governments, can represent 30-40% of a municipality's energy bill. At drinking water plants, the largest energy use (about 80%) is to operate motors for pumping. At wastewater treatment plants, aeration, pumping, and solids processing account for most of the electricity that is used.²⁴ The Indiana Finance Authority, in cooperation with IDEM, has promoted the use and installation of energy efficient pumps, pipes, treatment systems, and control processes as part of the state's Revolving Loan Program for financing water and wastewater infrastructure projects. Some examples of these projects include the installation of energy efficient variable frequency drive pumps at Fort Wayne and Jeffersonville, wastewater collection improvements to reduce the amount of water needing treatment in Logansport and New Albany, and water main replacement to prevent leakage in Owensville and Brooklyn. There have been over 25 projects improving energy efficiency since 2012. A rule requiring water utilities to address unacceptable leakage from their drinking water infrastructure was promulgated to improve efficiency and save energy by reducing the amount of water pumped and treated. Indiana plans to continue to take positive steps to improve the efficiency of utilities in the state not only because of the reduction in energy used, but also because it improves the affordability of the services to consumers. Energy savings made by water and wastewater utilities in the state should receive credit for reducing CO₂ emissions, and Indiana should be allowed to include these savings in its state plan.
- l. As technology advances and the cost of resource alternatives change, Indiana hopes that the definition of DSM/EE would also be appropriately expansive. This seems to have been recognized by U.S. EPA, but Indiana needs specific guidance demonstrating that U.S. EPA will be

²⁴ Congressional Research Service, Energy-Water Nexus: The Water Sector's Energy Use, Claudia Copeland, January 3, 2014

receptive to additional energy efficiency and demand reduction programs.²⁵

VII. Legal issues

- a. As stated in the cover letter, there are several issues with U.S. EPA's purported authority to regulate GHGs in the manner specified by the proposed rule. Regulations promulgated under 111(d) require that the agency first adopt standards under 111(b). The proposed predicate rules under 111(b) have not yet been finalized and may be invalidated upon judicial review. Therefore, U.S. EPA's attempt to regulate GHGs from existing EGUs is premature.
- b. The CAA does not grant U.S. EPA authority to regulate source categories under 111 when the sources are already subject to regulation under section 112.
- c. 111(d) does not permit outside the fence regulation of affected sources. If a state like Indiana is unable to develop a plan within the time frame prescribed, or should the state opt for a federal plan, U.S. EPA must have the authority to institute such a plan. U.S. EPA cannot impose requirements on states that the agency itself does not have the authority to enforce. In this case, U.S. EPA has inadequate authority to institute a plan based on how the agency applied BSER in determining the goal.

VIII. Miscellaneous

- a. The use of a single year for baseline establishment verses a multiyear baseline is inconsistent with common U.S. EPA practice. Whenever variability in meteorology or energy markets is involved, U.S. EPA tends to rely on a multi-year average base year. The demand for electricity varies based on meteorological swings (extreme cold or extreme hot). Additionally, the dispatch and utilization of coal and natural gas can vary based on outages and fuel prices. Therefore, the use of multiple years

²⁵ A utility pursuing aggressive EE/RE programs may avoid the construction of new fossil generating capacity and expansion of transmission and distribution capability, and may even allow the utility to retire non-economic generating units no longer required for generation or reliability purposes. State Plan Considerations -Technical Support Document (TSD), page 32.

would be a more appropriate method to normalize the data in characterizing a base year. 2012 was an unusual operating year for many Indiana coal-fired generating units. Some units, such as NIPSCO's R.M. Schahfer Generating Facility's Units 14 and 15, were involved in major construction projects to install FGD units to comply with the Mercury and Air Toxics Standards (MATS) and the Cross State Air Pollution Rule (CSAPR), so they did not operate at the capacity factors normally seen for those units.²⁶ Also, many base load coal-fired units did not operate at their highest capacity during 2012 because of low natural gas prices.²⁷ Indiana recommends that U.S. EPA use a 3-year average baseline for emissions, generation, and capacity factors, as opposed to relying on only 2012 data.

- b. Based on a review of U.S. EPA's technical support documents included as a part of the proposed rule, Indiana has identified several data points that are inaccurate specific to a number of active coal-fired facilities currently located in the state. This includes the classification of some of the state's facilities as "peakers". Details regarding this matter are included in Attachment B. There are additional concerns associated with the 2012 emissions data. For example, Duke Energy's Edwardsport Generating Station is a new coal gasification facility sited adjacent to the old Edwardsport power plant that had coal fired boilers. The old plant ceased operation prior to 2012 and the new Edwardsport IGCC plant was in the initial start of operations in 2012. The emissions data U.S. EPA used in the TSD for Edwardsport is in no way reflective of actual operating conditions and should be adjusted when evaluating Indiana's state goal. This facility ran very little during 2012, yet U.S. EPA data assumes this facility was operating at full capacity. The Edwardsport IGCC facility was conducting tests for operation and was not yet fully in service in 2012.²⁸ Furthermore, the Edwardsport IGCC used natural gas instead of coal for a significant portion of the time it was operational in 2012.²⁹ The future emission rate for this facility will likely be greater than the 2012 levels because this facility is designed to run primarily on synthesized gas from

²⁶ IURC, Final Order, Cause No. 44012, Phase I (December 28, 2011).

²⁷ Energy Information Administration. (October 19, 2012). **Today in Energy**. *Electricity from coal and natural gas both increased with summer heat*. <http://www.eia.gov/todayinenergy/detail.cfm?id=8450>
See also, Tierney, S. (July 30, 2012). **Power Magazine**. *Why Coal Plants Retire: Power Market Fundamentals of 2012*. <http://www.powermag.com/why-coal-plants-retire-power-market-fundamentals-as-of-2012/>.

²⁸ IURC, Cause Nos. 43114 IGCC 9-11, Direct Testimony of Petitioner's Witness Jack Stultz.

²⁹ *Id.*

coal. Indiana is concerned that the current emission rate targets for Indiana under the Clean Power Plan could prevent the Edwardsport IGCC plant from fully operating according to its original design. If this happens, Indiana ratepayers will bear more than \$2.5 billion in construction costs for this facility³⁰ without receiving the full benefits expected when the initial investment in the plant was originally approved in 2007.³¹ Under Indiana law and past orders from the IURC, the utility may recover approved construction costs even if the facility never operates to serve ratepayers.³² Preventing the Edwardsport IGCC plant from fully operating could represent a significant stranded cost issue for Indiana ratepayers, which is explicitly contrary to the intent of the rule.

- c. Indiana is recommending that U.S. EPA use the 2013 EIA growth forecast for goal estimation as opposed to 2010. There is a ten-fold difference between the two. As such, the most current growth forecast should be used, as this could have a substantial effect on future year goal development.
- d. Indiana urges U.S. EPA to reconsider and clarify when improvements at an EGU do or do not trigger NSR requirements. U.S. EPA should consider waivers or exemptions for facilities seeking to make substantial improvements to incentivize the reduction of CO₂ emissions if that is U.S. EPA's main objective in this rulemaking.
- e. U.S. EPA should consider how to equally evaluate all electric service providers including investor-owned utilities, municipal utilities, and rural electric membership cooperatives that supply power to the grid. These types of utilities are unique and may require special considerations, particularly rural cooperatives and smaller municipal utilities. These types of facilities generally service a lower number of members per line than larger utilities. Most of those serviced are rural customers that are in the lower income bracket. These utilities also service far fewer industrial customers than other utilities. As a result, the ability to implement Building Block 4 for these utilities is far more difficult and costly than for other utilities. Given the demographic make-up of the customers for these utilities, increases in rates will be felt much more deeply than for other utility customers since they not only have less income to pay for higher

³⁰ IURC, Final Order, Cause No. 43114 IGCC 4S1 (December 27, 2012): p. 92.

³¹ IURC, Final Order, Cause No. 43114 (November 20, 2007).

³² Indiana Code §8-1-8.5 through 8.7.

rates, but also less means to invest in energy efficiency measures. The economy of scale dictates that the costs for energy efficiencies for these areas will be much higher without the industrial component factored in.

- f. U.S. EPA is seeking comment concerning states receiving CO₂ credit for having sustainable forestry initiatives. Indiana disagrees that CAA Section 111 allows consideration of outside-the-fence control measures as part of a BSER analysis. However, if the final rule includes outside-the-fence measures, the credits available to states for GHG reductions should be expanded to include CO₂ sequestration through planting, maintenance, and management of state forests. Analyses on CO₂ sequestration through Afforestation and Improved Forest Management (two types of offset methodology) in Indiana indicate this would be an achievable emission-reduction strategy. Afforestation of 1.2 million non-prime, agricultural crop acres could yield 113 MMt CO₂e by 2020. An additional 4.8 million acres of non-federal timberland in Indiana could be tapped for improved CO₂ storage projects to further avoid 38.4 MMt CO₂e by 2020.
- g. U.S. EPA is requesting comment on co-firing as a compliance option. In some cases, it may be advantageous from both an emissions and a cost perspective standpoint. In other instances, it may result in stranded costs for pollution control equipment that is already installed, which would result in higher electric rates for Indiana. With a large number of coal-fired facilities in the state, this could have a significant impact on Indiana's future. Indiana is not opposed to this; however, it may not be economically viable for some co-firing options. Biomass co-firing would involve transportation of biomass to the facility. It may be cost prohibitive for facilities to bring in biomass from farther away but that may be required to keep a unit co-firing with biomass all year long. Indiana is not opposed to co-firing as an available compliance option, but Indiana is strongly opposed to this being a mandated requirement for EGUs.
- h. Indiana strongly believes that carbon capture and sequestration (CCS) should not be considered a technically viable option for facilities to install at this point. The technology is not commercially available, is still in the testing phase, uses large amounts of energy to operate, and to this point has not proven to be a cost effective way of reducing CO₂ emissions. Also, CCS retrofit technologies require space around the boiler to be installed. Many of Indiana's existing coal powered facilities currently lack sufficient space to install CCS.

Attachment B - Indiana EGU Information

MWh by unit 2010-2012

Plant Name*	Plant ID	Generator ID*	MWh		
			2010	2011	2012
Cayuga	1001	1	3006997	2708716	2499922
Cayuga	1001	2	2942935	2980872	2241972
Cayuga	1001	4			29904
Edwardsport	1004	6	-2249		
Edwardsport	1004	7	759		
Edwardsport	1004	7-2			
Edwardsport	1004	8	114894		
Noblesville	1007	1		0	125078
Noblesville	1007	2		0	125078
Noblesville	1007	CT3			190119
Noblesville	1007	CT4			190119
Noblesville	1007	CT5			190119
R Gallagher	1008	1	529324	172921	-221
R Gallagher	1008	2	683998	197247	160455
R Gallagher	1008	3	435038	215236	-406
R Gallagher	1008	4	647746	160943	83844
Wabash River	1010	1	0		288917
Wabash River	1010	1A	0		607789
Wabash River	1010	2	-6491	336500	204428
Wabash River	1010	3	-6490	375515	160152
Wabash River	1010	4	663031	561611	212569
Wabash River	1010	5	-6547	255975	45380
Wabash River	1010	6	2196166	2268660	986313
F B Culley	1012	2	231911	118731	215126
F B Culley	1012	3	1680233	1419877	1478186
Logansport	1032	4	47147	48374	87323
Logansport	1032	5	81779	76035	52069
Whitewater Valley	1040	1	79239	82180	7788
Whitewater Valley	1040	2	132040	148971	16161
Frank E Ratts	1043	1	754040	331202	257778
Frank E Ratts	1043	2	629848	442797	213190

Attachment B - Indiana EGU Information

MWh by unit 2010-2012

Plant Name*	Plant ID	Generator ID*	2010	2011	2012
Portside Energy	55096	ST	59810	70396	63216
Whiting Clean Energy	55259	ST1	181212	226397	433818
Whiting Clean Energy, Inc.	55259	CT2			
Sugar Creek Generating Station	55364	CT12	995720	1481632	2060582
Sugar Creek Power	55364	ST1	547484	795681	1081807
Lawrenceburg Energy Facility	55502	0100	280419	780682	1314065
Lawrenceburg Energy Facility	55502	0200	319437	727736	1227556
Lawrenceburg Energy Facility	55502	3			
Lawrenceburg Energy Facility	55502	4			
R M Schahfer	6085	14	2604124	1985324	1026579
R M Schahfer	6085	15	3101971	2456325	2318395
R M Schahfer	6085	17	1650724	1492026	964495
R M Schahfer	6085	18	2224039	1646464	1621219
R M Schahfer Generating Station	6085	16A			
R M Schahfer Generating Station	6085	16B			
Gibson	6113	1	3889754	3640274	3993076
Gibson	6113	2	4262185	3343689	3561103
Gibson	6113	3	4521931	3020374	3959527
Gibson	6113	4	4534957	3966891	3434865
Gibson	6113	5	3019070	3640192	3687015
A B Brown	6137	1	972644	937404	1135739
A B Brown	6137	2	1114094	1153977	1199440
A B Brown Generating Station	6137	3			
A B Brown Generating Station	6137	4			
Rockport	6166	AB1			
Rockport	6166	AB2			
Rockport	6166	1	9262063	6366692	9607065
Rockport	6166	2	8369683	10024637	9172504
Merom	6213	1	3430637	3405040	2924060
Merom	6213	2	3187918	3508662	2528452
Warrick	6705	1	1125450	1238620	1221012
Warrick	6705	2	1099046	1155853	992714
Warrick	6705	3	1147761	1091454	1130414
Warrick	6705	4	2228306	2041024	1924950
State Line Energy	981	3	1326144	1263066	222948
State Line Energy	981	4	2028364	1804427	312471
Clifty Creek	983	1	1197509	1457308	1062734
Clifty Creek	983	2	1206210	1416168	838206
Clifty Creek	983	3	1301175	1357286	1078953

Attachment B - Indiana EGU Information

MWh by unit 2010-2012

Plant Name*	Plant ID	Generator ID*	2010	2011	2012
Clifty Creek	983	4	1404681	1374731	956638
Clifty Creek	983	5	1436038	1072084	1000001
Clifty Creek	983	6	1353011	1270690	1009085
Tanners Creek	988	1	338372	249310	104798
Tanners Creek	988	2	273876	596828	158142
Tanners Creek	988	3	474976	433716	579170
Tanners Creek	988	4	2815361	2639142	1975008
Harding Street	990	3	1960	-63	-107
Harding Street	990	4	1561	-72	-109
Harding Street	990	5	635859	508646	560054
Harding Street	990	6	511598	499607	553345
Harding Street	990	7	2112435	2635920	2588041
IPL - Harding Street Station (EW Stout)	990	GT4			
IPL - Harding Street Station (EW Stout)	990	GT5			
IPL - Harding Street Station (EW Stout)	990	GT6			
Eagle Valley	991	ST1	45685	-524	-1830
Eagle Valley	991	2	855	-503	-1830
Eagle Valley	991	3	99182	120699	7378
Eagle Valley	991	4	282898	256779	41873
Eagle Valley	991	5	266940	184150	95582
Eagle Valley	991	6	483403	452849	172334
AES Petersburg	994	ST1	1488962	1188980	1469922
AES Petersburg	994	ST2	2752833	2626096	2370417
AES Petersburg	994	ST3	3916538	3487561	2688809
AES Petersburg	994	4	3657502	2749997	3111650
Bailly	995	7	934818	798171	625145
Bailly	995	8	1124961	1692438	1172895
Bailly Generating Station	995	10			
Michigan City	997	12	2286786	2962367	2341016
Michigan City	997	2	-491		0
Michigan City	997	3	-491		0
Michigan City Generating Station	997	4			
Michigan City Generating Station	997	5			
Michigan City Generating Station	997	6			

*Defaulted to the EIA Name and Generator ID when available

Attachment C - Indiana EGU Information

CO₂ Emissions by Unit 2010-2012

Plant Name*	Plant ID	Generator ID*	CO ₂ tons/year		
			2010	2011	2012
Cayuga	1001	1	3320253	2902708	2722055
Cayuga	1001	2	3094247	3076931	2452518
Cayuga	1001	4	5930.833	7531.304	26613.94
Edwardsport	1004	6			
Edwardsport	1004	7	55202.56		
Edwardsport	1004	7-2	74514.65		
Edwardsport	1004	8	56814.68		
Noblesville	1007	1			58671
Noblesville	1007	2			58671
Noblesville	1007	CT3	33184.74	39357.38	89179
Noblesville	1007	CT4	35850.91	61993.41	89179
Noblesville	1007	CT5	43581.27	68386.87	89179
R Gallagher	1008	1	533580.9	186969.8	600.247
R Gallagher	1008	2	682962.6	213724.6	185322.3
R Gallagher	1008	3	434966.2	212983.9	285.22
R Gallagher	1008	4	627700.3	166570.5	104913.1
Wabash River	1010	1	1085330	1220698	867703.4
Wabash River	1010	1A			547123
Wabash River	1010	2		356992.7	217970.6
Wabash River	1010	3		399535.8	174913.5
Wabash River	1010	4	755404.9	583224.2	230640.7
Wabash River	1010	5		207726.1	45049.49
Wabash River	1010	6	2408247	2331749	1082057
F B Culley	1012	2	321411.6	167362.4	297669.1
F B Culley	1012	3	2102175	1807707	1863457
Logansport	1032	4			
Logansport	1032	5			
Whitewater Valley	1040	1	107095	110483.1	11918.23
Whitewater Valley	1040	2	173727.8	191384.4	23269.62
Frank E Ratts	1043	1	774911.8	375532	298208.7
Frank E Ratts	1043	2	722442	505568.9	246215.7
Portside Energy	55096	ST			

Attachment C - Indiana EGU Information

CO₂ Emissions by Unit 2010-2012

Plant Name*	Plant ID	Generator ID*	2010	2011	2012
Whiting Clean Energy	55259	ST1	756302.4	778491.8	671070.8
Whiting Clean Energy, Inc.	55259	CT2	679247.4	661825.8	733409.3
Sugar Creek Generating Station	55364	CT12	698646	992525	1318616
Sugar Creek Power	55364	ST1	0	0	0
Lawrenceburg Energy Facility	55502	0100	145297.8	450137.8	735988.5
Lawrenceburg Energy Facility	55502	0200	165719.2	449414.6	702788.6
Lawrenceburg Energy Facility	55502	3	180113.6	420382.7	719331.2
Lawrenceburg Energy Facility	55502	4	192223.2	431614.6	667814.9
R M Schahfer	6085	14	3073039	2432371	1348084
R M Schahfer	6085	15	3855433	3107809	2914196
R M Schahfer	6085	17	2158313	1985361	1298856
R M Schahfer	6085	18	2803460	2106394	2102652
R M Schahfer Generating Station	6085	16A			
R M Schahfer Generating Station	6085	16B			
Gibson	6113	1	3672926	3475550	3830505
Gibson	6113	2	4470833	3412795	3650546
Gibson	6113	3	4724336	3252115	4269253
Gibson	6113	4	4190457	3765881	3340684
Gibson	6113	5	2621428	3399849	3394007
A B Brown	6137	1	1096546	1089810	1302533
A B Brown	6137	2	1267355	1370717	1446394
A B Brown Generating Station	6137	3	16911.51	11134.83	11270.86
A B Brown Generating Station	6137	4	12579.56	11309.34	15442.34
Rockport	6166	AB1			
Rockport	6166	AB2			
Rockport	6166	1	9565207	6555735	9996024
Rockport	6166	2	8655248	10423192	9569015
Merom	6213	1	3713669	3859008	3290971
Merom	6213	2	3303137	3718735	2801843
Warrick	6705	1	1418860	1542580	1491230
Warrick	6705	2	1280011	1450196	1187184
Warrick	6705	3	1461010	1390174	1428304
Warrick	6705	4	2606396	2374201	2293203
State Line Energy	981	3	1386324	1359680	252853.8
State Line Energy	981	4	2099493	1929851	354514.3
Clifty Creek	983	1	1168283	1432096	1097245
Clifty Creek	983	2	1187873	1382419	888028.8
Clifty Creek	983	3	1295683	1362689	1162469
Clifty Creek	983	4	1436094	1392166	1006310

Attachment C - Indiana EGU Information

CO₂ Emissions by Unit 2010-2012

Plant Name*	Plant ID	Generator ID*	2010	2011	2012
Clifty Creek	983	5	1452220	1082970	1055641
Clifty Creek	983	6	1373938	1308711	1061381
Tanners Creek	988	1	354335.3	250041.3	112051.5
Tanners Creek	988	2	298193.3	651931.1	177550.9
Tanners Creek	988	3	496108.1	440685.1	698855.8
Tanners Creek	988	4	2863493	2750137	1984282
Harding Street	990	3	2219.583	19.008	
Harding Street	990	4	707452.7	589321.2	619907.1
Harding Street	990	5	573611.5	554297	605682
Harding Street	990	6	2163393	2909457	2948839
Harding Street	990	7	2878.795	36.481	
IPL - Harding Street Station (EW Stout)	990	GT4	15227.6	15583.52	11109.51
IPL - Harding Street Station (EW Stout)	990	GT5	14548.33	17638.73	15407.59
IPL - Harding Street Station (EW Stout)	990	GT6	29387.52	34159.64	38216.14
Eagle Valley	991	ST1	3281.922	1593.096	
Eagle Valley	991	2	3248.314	1665.533	
Eagle Valley	991	3	122642.6	133055.1	11411.4
Eagle Valley	991	4	313852.7	289793.2	54659.49
Eagle Valley	991	5	289923.8	203030	100938.4
Eagle Valley	991	6	516421.8	488337.6	174666.4
AES Petersburg	994	ST1	1521763	1227703	1587047
AES Petersburg	994	ST2	2839436	2793348	2443006
AES Petersburg	994	ST3	4192143	3488090	2770284
AES Petersburg	994	4	4003160	3164077	3431412
Bailly	995	7	1227375	1038503	903058.5
Bailly	995	8	1433467	2068144	1543807
Bailly Generating Station	995	10			
Michigan City	997	12	2368750	3034602	2415243
Michigan City	997	2			
Michigan City	997	3			
Michigan City Generating Station	997	4			
Michigan City Generating Station	997	5			
Michigan City Generating Station	997	6			

*Defaulted to the EIA Name and Generator ID when available

Attachment D - Indiana EGU Information

Nameplate Capacity

Plant Name	Plant Id	Name Plate Capacity
A B Brown	6137	530
AES Petersburg	994	2150
Alcoa Warrick	6705	800
Bailly	995	600
Cayuga	1001	1062
Clifty Creek	983	1300
Eagle Valley	991	400
Edwardsport	1004	804.5
F B Culley	1012	370
Frank E Ratts	1043	235
Gibson	6113	3339.5
Harding Street	990	700
Lawrenceburg Energy Facility	55502	1230
Logansport	1032	25
Merom	6213	1080
Michigan City	997	540
Noblesville	1007	328
Portside Energy	55096	75
R Gallagher	1008	600
R M Schahfer	6085	1950
Rockport	6166	2600
State Line Energy	981	615
Sugar Creek Power	55364	555
Tanners Creek	988	1100
Wabash River	1010	1164.7
Whitewater Valley	1040	100
Whiting Clean Energy	55259	575

United States Senate Committee on Environment and Public Works
 March 11, 2015
 Hearing Entitled, "State Regulators' Perspectives on the Clean Power Plan."
 Questions for the Record to Thomas Easterly
 Commissioner, Indiana Department of Environmental Management

Senator Boxer:

"Question 1. According to its website, the Indiana Department of Environmental Management's (IDEM) mission "is to implement federal and state regulations to protect human health and the environment while allowing the environmentally sound operations of industrial, agricultural, commercial and government activities vital to a prosperous economy."

The 2014 National Climate Assessment was overseen by a 60-member Federal Advisory Committee, developed over four years by hundreds of the Nation's top climate scientists and technical experts, and informed by thousands of comments from the public and outside organizations gathered through town hall meetings, public-comment opportunities, and technical workshops across the country. It was peer reviewed by the National Academies of Sciences. Among many findings, it concluded that:

"Global climate is changing and this is apparent across a wide range of observations. The global warming of the past 50 years is primarily due to human activities;" and

"Climate change threatens human health and well-being in many ways, including through more extreme weather events and wildfire, decreased air quality, and disease transmitted by insects, food, and water."

As the Commissioner of IDEM dedicated "to protect human health and the environment" do you accept the extensive scientific, peer-review findings of the National Climate Assessment's final report?

Response: No. The National Climate Assessment report is, at best, incomplete. For example, in Key Message 2, the report acknowledges that we really don't know "how sensitive the Earth's climate is to those emissions." In the earlier report, "America's Climate Choices" (ISBN: 0-309-14586-4) released by the National Research Council in 2011, this uncertainty is more fully acknowledged. For example, Figure 5.1 on page 55 states:

"Key questions for setting each goal:

What is a 'safe' amount of climate change?
*Depends on the risks associated with given
 temperature targets, and decisions about willingness
 to tolerate these risks*

How does GHG concentration translate into global temperature change and other impacts?
Depends on climate sensitivity and the strength of other forcing factors (e.g., aerosols)

How does a given level of emissions translate into an atmospheric GHG concentration?
Depends on carbon cycle dynamics and the timing of emission reductions

What is a reasonable share of U.S. emission reductions relative to the global targets?
Depends on political, economic, and ethical judgments"

The report cited by Senator Boxer also completely ignores the impact of long-term ocean oscillations (The Atlantic and Pacific Decadal Oscillations) which have historically had significant impacts on the observed continental level climate.

There are too many variables affecting climate to draw conclusions as definitively as the report cited by Senator Boxer.

Question: "As the Commissioner of IDEM dedicated "to protect human health and the environment" do you think Indiana should act to significantly reduce carbon pollution from its power sector?"

Response: No. As in all decisions to protect Hoosiers and our environment, we look at both the positive and negative impacts of each proposed course of action. We then weigh those impacts to come up with a proposed course of action that is expected to cause the most benefit for the least harm. Those political decisions are often made by elected representatives who routinely balance multiple competing interests rather than an agency administrator, like me, who focuses on a narrower set of issues.

In the case of U.S. EPA's proposed Clean Power Plan, Indiana assembled a substantial group of stakeholders, inside and outside of state government to evaluate the proposal. The collective judgment of the State of Indiana, including IDEM, is that the obvious adverse impacts on disadvantaged people who already have challenges paying for the energy required to simply stay warm during the cold Indiana winter (which includes life threatening freezing temperatures) and the proven negative impacts on Indiana's manufacturing intensive economy (we are the most manufacturing intensive state in the United States) far outweigh the speculative benefits of U.S. EPA's proposal.

These speculative benefits include a reduction in global CO₂ concentrations of 1.5 ppm under the assumption that there is no increase in emissions in other countries as the international economy adjusts to higher costs for goods produced in the U.S. To put the 1.5 ppm in perspective, during the period from 1998 to 2012, global average CO₂ concentrations increased by 33 ppm, or 22 times the projected reduction expected from U.S. EPA's proposal.

Based upon these facts, even if all of the Key Messages of the document cited by Senator Boxer are correct, U.S. EPA's proposed Clean Power Plan will not materially impact the observed trend of increasing CO₂ concentrations in our atmosphere.

Many activities that reduce carbon emissions from Indiana power plants, including the continuing implementation of cost effective energy efficiency measures, and the diversification our energy portfolio are the right thing to do in the absence of any policy to reduce carbon. Indiana will continue to facilitate free market policies that allow those activities to continue in the pursuit of affordable, reliable energy. As documented by U.S. EPA's Clean Air Markets Data (CAMD), Indiana has reduced its CO₂ emissions by 20% since 2005 as a by-product of these activities.

“Question 2. Recent press reports have indicated that some state governments have sought to prevent state employees from using certain terms related to climate change in official communications.

To the best of your knowledge, has the Governor or any employee in his office or any employee of IDEM sought to prohibit any state employee from using the terms “climate change,” “global warming,” or “sustainability” in your state's public or inter-agency communications about the Clean Power Plan or in any official agency communication? “

Response: No.

Senator INHOFE. Thank you, Mr. Easterly.
 Todd Parfitt is the Director of the Wyoming Department of Environmental Quality. You are recognized.

**STATEMENT OF TODD PARFITT, DIRECTOR, WYOMING
 DEPARTMENT OF ENVIRONMENTAL QUALITY**

Mr. PARFITT. Good morning, Chairman Inhofe, Ranking Member Boxer and members of the Senate Environment and Public Works Committee.

My name is Todd Parfitt. I am the Director of the Wyoming Department of Environmental Quality. I thank the committee for inviting the State of Wyoming to share its perspective on the Clean Power Plan. The State of Wyoming has provided extensive comments to the Environmental Protection Agency on its proposed rule.

In Wyoming, we take great pride in how we manage our natural resources, providing for both environmental stewardship and energy production. As our Governor, Matt Mead, has stated, it is a false question to ask, do we want energy production or environmental stewardship? In Wyoming, we must and do have both.

Wyoming sends electricity to both the eastern and western power grids, reaching from Iowa to Washington. Wyoming generated 49.6 million megawatt hours of electricity in 2012, with 66 percent of this electricity consumed beyond our borders. This electricity generation includes 88 percent coal and 9 percent wind.

EPA's proposal impacts States differently. Each State has unique characteristics and energy portfolios that drive the application of each of the four building blocks. For Wyoming, the proposed goal is problematic and unrealistic to achieve. EPA is proposing a compressed time line in which States are to develop and submit their State plans. Considering the complexities of the proposal and developing a compliance plan, along with any needed State legislation, the time lines are problematic if not unrealistic. Wyoming's emission reduction required by 2020, which is 70 percent of the proposed State goal, is far greater than can be achieved through heat rate improvements alone. This disparity is often referred to as the cliff.

Wyoming's evaluation identified either data errors or incorrect assumptions in all four building blocks. I will focus on key concerns with block three, renewable energy, since it has the largest impact on Wyoming's proposed goal. One hundred percent of CO₂ emissions from fossil-fueled power plants, regardless of end user, will be attributed to the energy-producing State. Sixty-six percent of electricity generated in Wyoming is consumed outside its borders.

According to EPA, renewable energy credits will be attributed to the consuming State, not the producing State. Eighty-five percent of 4.3 million megawatt hours of wind energy generated in Wyoming is consumed outside its borders. Yet when EPA calculated Wyoming's State goal, they applied a 6 percent escalation factor to all 4.3 million megawatt hours generated in Wyoming.

More than half of the land in Wyoming is owned and managed by the Federal Government, subjecting many renewable transmission projects to NEPA. While the intent is good, the process is slow. A BLM high priority wind project took over 4 years for a

NEPA decision. Now the Fish and Wildlife Service requires an additional NEPA decision. Two Federal fast track transmission projects in Wyoming are in their eighth year of the NEPA process. Both are still awaiting a final decision.

Finally, EPA's assessment of available land in Wyoming for wind energy development failed to consider high priority environmental conflicts such as greater sage grouse habitat, other designated critical habitats, and protected areas of cultural and historical significance. Factoring in these considerations reduces available lands for renewable, as proposed, by 83 percent. All of these factors lead to an unrealistic goal for Wyoming.

Now, directing your attention to the two graphs. Graph one depicts as a bar graph Wyoming's glide path as proposed by EPA.

Senator INHOFE. Which one is one?

Mr. PARFITT. Graph one is on your right.

Graph one depicts a bar graph of Wyoming's glide path as proposed by EPA. One can observe the dominant influence of the renewables component as shown in green.

After review, Wyoming determined what is practically achievable, given EPA's proposed avenues. This is shown in graph two. The line in the graph represents Wyoming's carbon emission requirements according to EPA's analysis. The colored bars were derived through extensive analysis by the State, representing what may be possible in Wyoming.

As can be seen, there is a wide gap between EPA's and Wyoming's analysis. Based on the proposed goal and with limited options, the simplest illustration to show an avenue for Wyoming to meet the initial 2020 goal is to consider how many coal-fired power plants must be closed. This would result in four plants closing, representing nearly 4,200 megawatts of the State's total coal fleet of over 6,700 megawatts. Stranded investment for these four would be nearly \$1.5 billion, and does not include the cost of replacement power.

We look forward to continued dialog with EPA and the other States as EPA considers our comments and reconsiders their proposal. Thank you for allowing me to provide input to your committee.

[The prepared statement of Mr. Parfitt follows:]

WRITTEN TESTIMONY OF TODD PARFITT, DIRECTOR
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

BEFORE

THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

HEARING ON:

“STATE REGULATORS’ PERSPECTIVES ON THE CLEAN POWER PLAN”

MARCH 11, 2015

Good Morning Chairman Inhofe, Ranking Member Boxer, and members of the Senate Environment and Public Works Committee. My name is Todd Parfitt. I am the Director of the Wyoming Department of Environmental Quality (WDEQ). I thank the committee for inviting the State of Wyoming to share its’ perspective on the Clean Power Plan. The State of Wyoming has provided extensive comments to the Environmental Protection Agency (EPA) on its proposed rule.

Wyoming is home to Yellowstone National Park, Devil’s Tower and many more beautiful places. Our citizens and visitors expect these places to have the best environmental stewardship. Wyoming’s abundant mineral resources provide its citizens and the state with the jobs and tax revenue necessary to thrive. In Wyoming, we manage our natural resources exceptionally well, providing for both environmental stewardship and energy production. As our governor, Matt Mead, has stated, “It is a false question to ask: Do we want energy production or environmental stewardship?” In Wyoming, we must and do have both.

To understand Wyoming’s perspective one would first benefit from knowing some key characteristics of the state. Wyoming is the 9th largest state covering 97,814 square miles, yet hosts the smallest population of any state, at approximately 584,000. Much of the state is still unsettled and consists of many rural communities with large distances in between. There are only nine (9) “cities” in Wyoming with populations greater than 10,000. More than half of the land in Wyoming is owned and managed by the federal government.

Wyoming is the number one exporting state of British thermal units (Btu’s) to the country, contributing 12.2% of all the Btu’s produced in the U.S. in 2012; the number one producer of coal representing 40% of the nation’s coal production and delivering to power plants in 32 states. Wyoming is fifth in production of natural gas; eighth in crude oil production; number one in uranium; number one in bentonite; number one in trona; and Wyoming has the most class 5-7 categories for wind energy resources in the continental United States.

Wyoming is also a leader in developing and providing electricity to many states. Wyoming sends electricity to both the eastern and the western power grids, reaching from Iowa to Washington. Wyoming generated 49.6 million Megawatt-hours of electricity in 2012¹, with 66% of this electricity consumed beyond our borders. This electricity generation is comprised of 88% coal, 9% wind, and the remainder from natural gas and hydropower.

On June 18, 2014, EPA proposed its rules pertaining to existing power plants. This initiated an unprecedented level of regulatory review for the State of Wyoming. The Wyoming Department of Environmental Quality coordinated with the Wyoming Public Service Commission (WYPSC) and provided extensive comments to EPA.

The EPA has proposed to reduce CO₂ emissions from electric generating units (EGUs) through a series of four Building Blocks

- 1 - Efficiency upgrades at coal units of 6%;
- 2 - Increase utilization of natural gas generation to 70%;
- 3 - Increase utilization of renewable energy resources and nuclear fleets; and
- 4 - Decrease use of electricity through demand-side energy efficiency.

As one reviews the 1,600 plus pages of the proposal it is apparent that it will impact states differently. Each state has unique characteristics and energy portfolios that drive the application of each of the four building blocks. For Wyoming, the goal is problematic and unrealistic to achieve.

In this action, EPA is proposing state-specific emission goals for CO₂ from the power sector, as well as guidelines for states to follow in developing plans to achieve the state-specific goals. EPA has on numerous occasions described the proposed rule as flexible, and that it was developed to provide a framework under which states can develop their own individual plans. As the State reviewed the proposed rule, it became evident that the rule does not provide flexibility for Wyoming. For reasons I will discuss shortly, the establishment of state-specific guidelines through the implementation of four building blocks makes the rule inflexible.

One concern with the proposed rule is the timing. This is a very complex rule that will require tremendous coordination to develop a compliance plan. Typical time associated with State Implementation Plan (SIP) submittals is three years, yet in this case the EPA is proposing a compressed timeline in which states are to develop and submit their state plans. States developing individual plans are given one year while states considering working together may be given two years. As proposed, EPA will review and issue a determination within one year after receiving a complete plan.

The emission reductions EPA requires of Wyoming by 2019 is far greater than can be achieved through heat rate improvements alone. This disparity is often referred to as the "cliff". EPA's methodology proposes Wyoming reduce the rate of CO₂ emission from 2,331 lbs/MWh to 1,899 lbs/MWh. This equates to 70% of the proposed state goal being achieved within one, possibly two years. Quoting the WYPSC, *"...there are reasons to believe that the entire Section 111(d) program will cause a contraction of*

¹ U.S. Energy Information Administration

Wyoming's economy, due to its impact on Wyoming's coal industry; to the premature retirement of a major portion of Wyoming's coal fleet; and to the resulting increase in electricity rates...."

The first building block involves heat rate improvements and is focused on measures power plant operators can put in place to improve the process by which electricity is generated. The proposed goal for heat rate improvements of 6% for EGUs in Wyoming is not achievable. Our utilities have found 2% to be more in line with what is achievable. EPA's goal is based on general assumptions that are not representative of Wyoming EGUs capabilities. In particular, many plants in Wyoming have already taken steps to improve heat rates by upgrading their steam turbines and replacing aging equipment. EPA also assumes the efficiency upgrades will largely be paid off by lesser coal purchases. Wyoming's fuel costs are among the lowest in the nation, evaporating any opportunity to offset these excessive costs.

In the proposed rule, EPA expects operators to have heat rate improvements in place by 2019. This is a concern for Wyoming utilities that are juggling compliance and installation of additional technologies resulting from numerous other EPA regulations. EPA should allow gradual implementation of heat rate improvement projects. Implementation of the remaining three building blocks is allowed to occur throughout the compliance period, 2019 through 2029.

Building block two is the re-dispatch of existing or under construction natural gas combined cycle power plants. Wyoming has little natural gas generation, rendering this component near moot, minus one incorrect assumption by EPA regarding the sole natural gas generating unit in Wyoming.

Building block three is renewable energy. EPA credited all of the wind generated in Wyoming to our renewable goal, some 4 million Megawatt-hours, and subsequently applied an unrealistic growth factor. Wyoming consumes only 666,212 Megawatt-hours of this amount while exporting 85% of the wind energy to other states. Since EPA incorporated all the renewable production in Wyoming into our goal, EPA's proposal requires Wyoming consumption to increase to 9.4 million Megawatt-hours by 2030. This is a 1,415% increase, equivalent to a 52% renewable portfolio standard.

During the course of the public comment period, EPA acknowledged a discrepancy in how state goals were calculated and how compliance with the interim and final state goals would be determined. EPA has said that renewable energy will be credited to the consuming state, not the hosting state. But host states will be responsible for all carbon reductions, regardless of export considerations. This inconsistency can potentially put electricity producing states, like Wyoming, at a severe disadvantage. Wyoming is being asked to take full responsibility of meeting EPA's carbon reduction goal, though we export 66% of our electricity. At the same time, Wyoming is being asked to increase renewable energy growth based on the total amount of renewables currently in the state, even though only 15% is actually consumed within Wyoming. This results in an inflated and unattainable goal for Wyoming.

The proposal includes an annual escalation factor for renewable energy which is intended to reflect the average past performance of an eleven-state region designated as "the West". The result is an EPA-derived growth rate of 6.095%. The WDEQ performed an analysis using the same data EPA relied upon and determined that the average annual state growth rate for renewables in the region was 0.95%, significantly lower than EPA's.

Not only is the renewable component by itself a major obstacle for Wyoming, but the time involved for permitting the development of renewable energy can be a significant challenge. The presence of federal land ownership in Wyoming subjects renewable and transmission projects to review under the National Environmental Policy Act (NEPA). While the intent is good, it has been WDEQ's experience that permitting projects often involve multiple NEPA processes. The NEPA process adds considerable time to renewable energy projects. NEPA processes for wind facilities and transmission lines have a proven track record of taking at least eight years. In some cases, even after such a lengthy approval process, only a partial decision is rendered, allowing only a portion of the project to move forward. Further time may be necessary should additional Environmental Impact Statements (EIS) or Environmental Assessments (EAs) be required by other Federal Agencies. For example, if the Wyoming Bureau of Land Management (BLM) requires an EIS for a decision regarding a wind facility, the elements of the BLM's analysis do not automatically satisfy an EIS process stipulated by the U.S. Fish and Wildlife Service (FWS) for an Eagle Take Permit. These ancillary federal requirements, to which Wyoming has no authority over, present obstacles that will hinder Wyoming's ability to make reductions given EPA's truncated timeframe.

The most recent wind energy facility in Wyoming, on federal land, was considered a high priority project by the Administration. A notice of intent was issued by the BLM in 2008, and a decision was issued in 2012; however, the BLM has required additional, site-specific NEPA work before the project can proceed to construction. Further, the FWS requires an additional NEPA process for an Eagle Take Permit. That decision is not anticipated until 2016. If approved, it will authorize only half the facility to be constructed. Additional approval from FWS will be required to build the entire facility, as planned. The NEPA process will span 8 years for partial approval of a fast-tracked project.

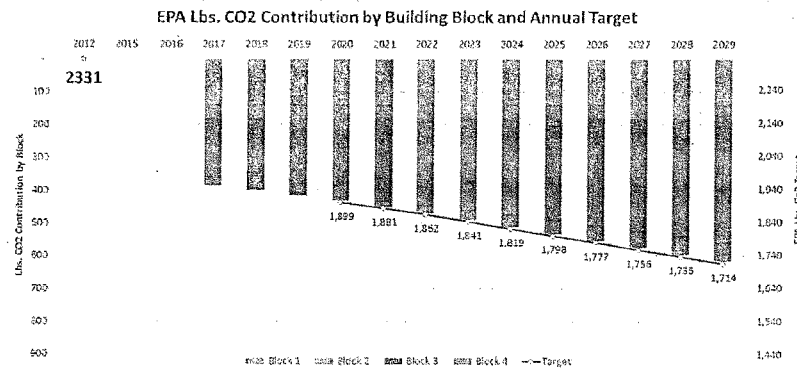
The NEPA processes for transmission lines have had similar experiences. Two federal 'fast-track' transmission projects in Wyoming began the NEPA process in 2008. Both are still awaiting a final decision. These examples demonstrate that it is unrealistic for Wyoming to build renewable energy and transmission projects within EPA's time line.

EPA assessed the amount of land available for renewable energy development. The largest technical potential in Wyoming is for wind energy, and the amount of land available for such development was assumed to be 110,415 km². However, the EPA failed to consider high-priority, environmental conflicts specific to Wyoming that greatly reduce the actual amount of land available. Considerations for Greater Sage-Grouse habitat, other designated critical habitats, and other protected areas of cultural and historical significance were not taken into account. In reality, only 20,158 km² are potentially available for wind development. Accounting for the wind energy projects already built or permitted in this area (1,888 km²), the total available land is further reduced to 18,270 km². Therefore, only 16.5% of the total land area EPA identified for wind energy development is actually available.

Building block four is demand side energy efficiency. EPA set goals for the fourth block based upon broad conclusions from other states' success with energy efficiency programs. The WYPSC performed a detailed analysis of energy efficiency saving potential in Wyoming. Based on Wyoming's low population, industrial-based load, and other factors, the proposed goal for Wyoming is unrealistic. Wyoming has offered a more realistic potential for building block four based on a state specific analysis.

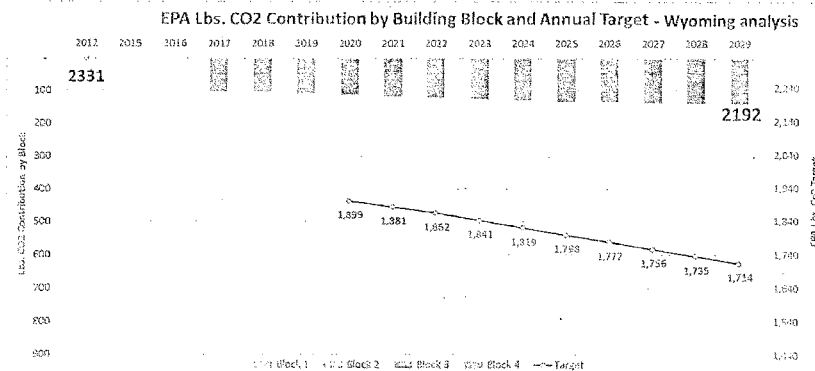
Graph 1 below depicts as a bar graph Wyoming's glide path as proposed by EPA. One can observe the dominant influence of the renewables component.

Graph 1: EPA Lbs. Contribution by Building Block and Annual Target



After review, the WYPSC and WDEQ determined what is practically achievable given EPA's proposed avenues. This is shown below. The line in the graph represents Wyoming's carbon emission requirements according to EPA's analysis. The colored bars were derived through extensive analysis by the WYPSC and WDEQ, representing what may be possible in Wyoming. No adjoining analysis was completed estimating the cost of this projection.

Graph 2: EPA Lbs. Contribution by Building Block and Annual Target – Wyoming analysis



As can be seen, there is a wide gap between EPA's and Wyoming's analyses. The bars in Graph 2 show the outer limit of the practical for Wyoming – a final emission rate of 2,192 lbs/MWh as opposed to EPA's target of 1,714 lbs/MWh hour. Wyoming may practically be able to achieve 22% of what EPA intends, without consideration to costs of achieving such reductions.

Based on EPA's overstated carbon reduction goal for Wyoming, and given the fact there are limited options for Wyoming to achieve this goal, the simplest illustration to show an avenue for Wyoming to meet the initial 2020 goal is to consider how many coal fired power plants must be closed. It was assumed the state would shut down coal plants in order of scheduled full depreciation to minimize stranded investments, though plants will not be fully depreciated within EPA's timeframe.

- Premature closure of Dave Johnston, 816 megawatts
- Premature closure of Naughton, 707 megawatts
- Premature closure of Jim Bridger, 2,317 megawatts
- Premature closure of Wyodak, 335 megawatts

This represents 4,175 megawatts of the states total coal fleet of 6,748 megawatts. This is Wyoming's "cliff". The WYPSC determined the amount of stranded investment for these power plants at the year 2020 to be \$1.491 billion:

- Dave Johnston: \$393 million
- Naughton: \$326 million
- Jim Bridger: \$524 million
- Wyodak: \$248 million

These power plants are owned by PacifiCorp, which serves a six-state territory. These costs will be spread to ratepayers within the territory and do not include the cost of replacement power.

In closing, I would also like to note that it is also important to Wyoming that the 111(d) process does not cause EPA to fall behind on its approval of other state air quality plans. This is an especially important issue as the Environmental Council of States, the Air Quality Associations and individual States have worked closely with EPA to develop a plan that addresses EPA's backlog of SIP reviews and approvals. We are concerned that 111(d) will add to the abundance of new regulations emanating from EPA and their impact on states' resources. In the air programs alone, there have been dozens of new rules in the past several years, including a proposal for a new ozone standard. States have primacy over the regulation of air quality, therefore EPA relies heavily upon the states to carry out these initiatives. We are the "boots on the ground" that ensure that the nation's priorities in cleaning up the air and protecting human health are achieved. But, state resources are being stretched ever more thin. As EPA continues to propose regulations at their current pace, they must consider the ability of states to meet this demand.

We look forward to continued dialogue with EPA and the other states as EPA considers our comments and reconsiders their original proposal.

Thank you for allowing me to provide input to your deliberations.

United States Senate Committee on Environment and Public Works
March 11, 2015
Hearing Entitled, "State Regulators' Perspectives on the Clean Power Plan."
Questions for the Record to Todd Parfitt
Director, Wyoming Department of Environmental Quality
Senator Boxer:

1. According to its website, "Since 1973, the Wyoming Department of Environmental Quality (DEQ) has served as the state's regulatory agency charged with protecting, conserving and enhancing Wyoming's land, air and water for the benefit of current and future generations."

The 2014 National Climate Assessment was overseen by a 60-member Federal Advisory Committee, developed over four years by hundreds of the Nation's top climate scientists and technical experts, and informed by thousands of comments from the public and outside organizations gathered through town hall meetings, public-comment opportunities, and technical workshops across the country. It was peer reviewed by the National Academies of Sciences. Among many findings, it concluded that:

"Global climate is changing and this is apparent across a wide range of observations. The global warming of the past 50 years is primarily due to human activities;" and
"Climate change threatens human health and well-being in many ways, including through more extreme weather events and wildfire, decreased air quality, and disease transmitted by insects, food, and water."

As a Director of Wyoming DEQ charged with protecting conserving and enhancing Wyoming's land, air and water for the benefit of current and future generations, do you accept the extensive scientific, peer-review findings of the National Climate Assessment's final report?

Response: To my knowledge, EPA has accepted the findings of the National Climate Assessment final report and this topic is not at issue for this hearing. What is at issue is EPA's proposed Clean Power Plan rule for which, as I have stated, is fraught with many problems including but certainly not limited to: incorrect assumptions, inequitable distribution of CO₂ emission attribution and renewable energy credits, failure to take into consideration stranded assets and unrealistic timeframes for compliance. In my view, EPA has proposed a rule that is unworkable for many states, including Wyoming.

As a Director of Wyoming DEQ charged with protecting conserving and enhancing Wyoming's land, air and water for the benefit of current and future generations, do you think Wyoming should act to significantly reduce carbon pollution from its power sector?

Response: *Not in the way that EPA has proposed and for the reasons stated above.*

An alternative approach to EPA's proposal is to invest and promote innovation and technology focused on beneficial use of carbon through product development and capitalizing on an abundant low cost resource, similar to the type of research and innovation already being financed and pursued in Wyoming with Wyoming resources. This approach creates win/win outcomes instead of the proposed win/lose proposition of the Clean Power Plan.

2. Recent press reports have indicated that some state governments have sought to prevent state employees from using certain terms related to climate change in official communications. On March 12, 2015, and March 19, 2015, my office entered the terms "climate change" and "global warming" into the search function of the Wyoming DEQ's website. The search yielded no results for either term.

To the best of your knowledge, has the Governor or any employee in his office or any employee of the Wyoming DEQ sought to prohibit any state employee from using the terms "climate change," "global warming," or "sustainability" in any of your state's public or inter-agency communications about the Clean Power Plan or in any official agency communications?

Response: *To the best of my knowledge, neither the Governor nor any employee in his office or any employee of the Wyoming DEQ have sought to prohibit any state employee from using the terms "climate change," "global warming," or "sustainability" in any of the state's public or inter-agency communications about the Clean Power Plan or in any official agency communications.*

Senator INHOFE. Thank you, Mr. Parfitt.
 Ellen Nowak is a Commissioner, Public Service Commission of Wisconsin. You are recognized.

**STATEMENT OF ELLEN NOWAK, COMMISSIONER, PUBLIC
 SERVICE COMMISSION OF WISCONSIN**

Ms. NOWAK. Good morning, Chairman Inhofe, Ranking Member Boxer and members of the committee.

Thank you for the opportunity to speak on behalf of the State of Wisconsin and provide you with a summary of our State's assessment and concerns with the EPA's Clean Power Plan.

My name is Ellen Nowak. I am the chairperson for the Public Service Commission of Wisconsin. Last fall, I was intimately involved with the construction of the comments that the State of Wisconsin submitted to the EPA. I submitted those comments, together with our analysis, with my written testimony for the record.

Wisconsin is a manufacturing-heavy State, with industrial customers representing over one-third of energy sales. More than 60 percent of our State's power generation comes from coal. If the problems in the Clean Power Plan are not remedied, the work Wisconsin has done to restore our manufacturing sector will be threatened.

As a regulator, I also remain concerned about the reliability of the grid, considering the dramatic, fast shift in energy production required by this proposal. With that background, and because of the far-reaching impacts of the EPA's Clean Power Plan, we brought together an interdisciplinary team. This team consisted of public service commission experts in utility rate modeling, economics, environmental regulation and engineering, along with department of natural resource experts in environmental regulation, particularly the Clean Air Act. Using a standard accepted utility modeling program, we forecasted the cost of this regulation under a number of scenarios with varying assumptions about the future.

Candidly, our team felt that taking into account the impacts of this regulation on every family and every business in the United States is the kind of analysis that should have been done by the EPA before making such a proposal. The results of our analysis have been provided to the committee. Here are two highlights.

First, this single Federal regulation will cost Wisconsin ratepayers between \$3.1 billion and \$13.4 billion. This is only a production cost increase. It does not include necessary upgrades to the gas and electric transmission infrastructure that will add significantly to the cost of compliance. These costs are also on top of the \$11.6 billion in carbon dioxide reduction measures that Wisconsin ratepayers have paid for since 2000. Not only do we not receive credit for these investments under the Clean Power Plan, but the proposal actually penalizes Wisconsin for being an early actor.

Second, as our assumptions about this rule became more realistic, the cost rose. For instance, would you assume that this massive increase in reliance on natural gas would drive natural gas prices higher? That very reasonable assumption significantly raises the cost of this regulation.

At the heart of the matter, we question the very foundation of this proposal. The EPA constructed four building blocks, each of

which was evaluated independently. Then to determine the foundation for each State's target reduction, the best system of emission reduction, or BSER, they added the carbon dioxide reductions resulting from each of those individual building blocks.

Unfortunately, EPA ignored how the building blocks would affect each other when all four were implemented together. For example, increasing reliance on natural gas, as suggested by building block two, would severely decrease the heat rate improvement achievable in the coal fleet to far below the 6 percent required under building block one.

Furthermore, EPA used indiscriminate and unsupportable approaches to determine the four building blocks. For example, building block one applies a national level heat rate improvement to each coal-fired plant, regardless of the ability of an individual plant to realize these gains. In contrast, building block three, the State renewable goals, takes a regional approach and is driven by the average renewable portfolio standards found in States arbitrarily grouped together.

As it is currently written under any previous interpretation of the Clean Air Act, the BSER system proposed by the EPA is actually not a system at all. First, the building blocks are outside the coordination and control of the emission unit owner or operator. Second, they are not recognizable systems of work or practice or control that can be applied to an emission unit. And third, they cannot guarantee a certain, conclusive greenhouse gas emission reduction when implemented as a whole.

To further highlight this point, engineers at the Public Service Commission modeled the EPA plan and concluded the building blocks would deliver a 15.6 percent reduction in carbon dioxide emissions. This is a far cry from the 34 percent that the EPA claims is attainable and necessary for Wisconsin to comply.

Finally, the compliance timelines in the proposal are unrealistic and unworkable. The lead time required for planning, permitting and construction, not to mention the EPA's own requirements, will require the full proposed compliance period through the end of 2030.

In conclusion, I sincerely appreciate the opportunity to speak to this esteemed committee today. You will find my submitted written testimony delves much deeper into the issues of modeling and the technical aspects of the rule that we find troubling.

We can all agree on the need to protect our environment. But this proposed rule does not strike the right balance in protecting public health, reliability of the grid and economic security. Thank you very much.

[The prepared statement of Ms. Nowak follows:]



Public Service Commission of Wisconsin

Ellen Nowak, Chairperson
Phil Montgomery, Commissioner
Mike Huebsch, Commissioner

610 North Whitney Way
P.O. Box 7854
Madison, WI 53707-7854

**Written Testimony of
Chairperson Ellen Nowak
Wisconsin Public Service Commission**

**Before the
Committee on Environment and Public Works
United States Senate**

**On
"State Regulators' Perspectives on the Clean Power Plan"**

March 11, 2015

Good morning Chairman Inhofe, Ranking Member Boxer, and Members of the Committee.

Thank you for the opportunity to provide written testimony on behalf of the State of Wisconsin and to provide you with a summary of our state's assessment of and concerns with the EPA's "Clean Power Plan." My name is Ellen Nowak and I am the Chairperson for the Public Service Commission of Wisconsin. Last fall, I was intimately involved with the construction of the comments the State of Wisconsin submitted to the EPA last December.

Wisconsin is a manufacturing heavy state, with more than 9,400 manufacturers employing approximately 475,000 people. Those industrial customers represent over one-third of energy sales. Milwaukee, our state's largest city, was recently named one of the top five destinations for manufacturing in the nation. Also, just over 60% of our state's power generation comes from coal. If the issues in the "Clean Power Plan" are not remedied, the work Wisconsin has done to restore our manufacturing sector will be threatened. As a regulator, I also remain concerned about the reliability of the grid considering the dramatic, fast shift in energy production required by this proposal.

With that background and because of the far-reaching impacts of the EPA's "Clean Power Plan," we brought together an interdisciplinary team made up of Public Service Commission experts on utility rate modeling, economics, environmental regulation and engineering and Department of Natural Resources experts on environmental regulation and, in particular, the Clean Air Act. Using a standard, accepted utility modeling program utilized by the Midcontinent Independent System Operator or MISO, our Wisconsin team forecast the cost of this regulation under a number of scenarios making different assumptions about the future.

This is the kind of analysis that should have been done by the EPA to take into account the impacts of this regulation on every family and every business in the United States.

Telephone: (608) 266-5481

Fax: (608) 266-3957

Home Page: <http://psc.wi.gov>

TTY/TextNet: In Wisconsin (800) 251-8345, Elsewhere (608) 267-1479

E-mail: PSCRecordsMail@wisconsin.gov

The results of our analysis have been provided to the Committee. Here are two highlights:

- First, this single federal regulation will cost Wisconsin ratepayers between \$3.3 billion and \$13.4 billion dollars.
- Second, as our assumptions became more realistic, the cost increased. For instance, would you assume this massive increase in reliance on natural gas would drive natural gas prices higher? That very reasonable assumption significantly raises the cost of this regulation.

But before I talk about compliance, it is critical to note that we question the technical and legal foundation of the proposal. The EPA constructed four building blocks, each of which was evaluated independent of each other, and added the carbon dioxide reductions resulting from each of those individual blocks to determine the Best System of Emission Reduction (BSER), which is the foundation for each state's target reduction.

The EPA committed a fundamental flaw when constructing the BSER because they ignored how the building blocks would affect each other when implemented together. For example, increasing reliance on natural gas, as suggested by building block 2 would severely decrease the heat rate improvement achievable in the coal fleet to far below the 6% required under building block 1. In fact, engineers at the Public Service Commission modeled the EPA plan and concluded their building blocks would deliver a 15.6% reduction in carbon dioxide emissions, a far cry from the 34% that the EPA claims is attainable for Wisconsin.

Moreover, the EPA used arbitrary and unsupportable approaches to determine the four building blocks. For example, building block 1 applies a national-level heat rate improvement to each coal-fired plant, regardless of the ability of an individual plant to realize these gains. In contrast, building block 3, state renewable goals, takes a regional approach, and is driven by average renewable portfolio standards found in states arbitrarily grouped together.

Even more problematic with the EPA's treatment of renewable energy under building block 3 is that the EPA's proposed approach requires states that have already made significant investments in renewable energy to expand renewables more than states that have been slower to act. We also noted that the EPA needs to establish clear guidelines to allow states that own renewable generation in another state or purchase such generation to claim credit for that energy. Specifically, the EPA must clarify that the state paying for the renewable generation may claim credit for that generation regardless of where the generation physically occurs. Allowing the state in which the generation is located to claim the credit would be unfair to entities who have made investments in out-of-state renewable generation to optimize use of renewable resources.

Finally, the BSER proposed by the EPA is not a system at all, under any previous interpretation of the Clean Air Act. EPA's four building blocks as proposed are outside the coordination and control of the emission unit owner or operator, are not recognizable "systems" of work practice

or control that can be applied to an emission unit, and cannot guarantee a certain, conclusive greenhouse gas emission reduction when implemented as whole.

The selection of 2012 as the baseline year is also flawed. 2012 was a highly unusual year for the power system, unlike any single previous year. Low gas prices resulted in unusually high reliance on natural gas for generation, resulting in a deceptively low starting point from which to make reductions.

Furthermore, the use of 2012 as a baseline fails to credit states, like Wisconsin, that took action before that year to reduce their carbon dioxide emissions via measures such as plant closures, fuel switching to natural gas, and installation of renewable electricity, just to name a few. In fact, since 2000, Wisconsin utilities have invested, and ratepayers are still paying for, more than \$11.6 billion in carbon dioxide reduction measures. Not only does Wisconsin not receive credit for these investments, but we are actually penalized under every single building block for our early action.

Assuming the proposal survives the technical and legal flaws, compliance with the proposal presents other concerns. First and foremost, the EPA failed to adequately consider the total costs of the proposed rule, as required by Section 111(a) of the Clean Air Act. As I noted earlier, PSC's modeling estimates that the costs to comply with the EPA's proposal over the compliance period ranges from \$3.3-\$13.4 billion. This is only a production cost increase, and does not include necessary upgrades to the gas and electric transmission infrastructure that will add significantly to the cost of compliance. EPA also does not include provisions to avoid stranded costs and it is not clear that the agency considered the remaining useful life of these generators when determining the cost and impact of the rule.

Maintaining reliability of the grid is a critical element in successful implementation of this proposal, yet it is clear the EPA failed to provide a complete analysis of how grid reliability can be maintained during compliance. EPA must thoroughly consult with each of the independent system operators, regional transmission operators, NERC and FERC before releasing a final rule. There must be an evaluation of the proposal's impact on generation resource reserve margins and an understanding of what resources will be called on to meet those reserves. At a minimum, EPA should provide states a safety valve to ensure the reliability, safety and security of the electrical grid.

Finally, the timelines in the proposal for compliance are unrealistic and unworkable. The lead time required for planning, permitting and construction, not to mention EPA's own requirements, will require the full proposed compliance period, through the end of 2030. This time will minimize compliance costs and allow states to prudently plan for these significant changes to the power sector.

We all agree on the need to protect our environment, but the proposed rule does not strike the balance needed to protect public health, reliability of the grid and economic security.

I sincerely appreciate the opportunity to speak in front of this esteemed committee today, my submitted written testimony delves much further into the issues of modeling and technical aspects of the rule that are beyond troubling. If you have questions or concerns that cannot be answered today, I will gladly have PSC staff work with you at any time.

Thank you.

**United States Senate Committee on Environment and Public Works
March 11, 2015
Hearing Entitled, "State Regulators' Perspectives on the Clean Power Plan."**

**Questions for the Record to Ellen Nowak
Commissioner, Public Service Commission of Wisconsin**

Senator Boxer:

1. The website of the Public Service Commission of Wisconsin (PSC) states as its vision, "We will be a leader in the state and in the nation by facilitating, promoting and ensuring the availability of affordable, reliable, environmentally sound and safe utility services." It also states the PSC envisions a world where "ENVIRONMENTAL PROTECTION is an integral part of everyone's responsibility for today's customers and for future generations." And as part of its mission, the PSC states that it will "ENSURE utility services are provided in an efficient AND environmentally responsible manner."

The 2014 National Climate Assessment was overseen by a 60-member Federal Advisory Committee, developed over four years by hundreds of the Nation's top climate scientists and technical experts, and informed by thousands of comments from the public and outside organizations gathered through town hall meetings, public-comment opportunities, and technical workshops across the country. It was peer reviewed by the National Academies of Sciences. Among many findings, it concluded that:

"Global climate is changing and this is apparent across a wide range of observations. The global warming of the past 50 years is primarily due to human activities;" and
"Climate change threatens human health and well-being in many ways, including through more extreme weather events and wildfire, decreased air quality, and disease transmitted by insects, food, and water."

As a Commissioner carrying out the vision and mission of the Public Service Commission of Wisconsin, do you accept the extensive scientific, peer-review findings of the National Climate Assessment's final report?

Since its inception in 1907, the Public Service Commission of Wisconsin (PSC) has remained true to its mission of, "being a leader in the state and in the nation by facilitating, promoting and ensuring the availability of affordable, reliable, environmentally sound and safe utility services." As a semi-judicious and regulatory entity, the PSC does not set, but rather implements policy dictated by the legislature of the state of Wisconsin. When the PSC has the purview to make a determination in a case before them, the entirety of the record is taken into account. This includes environmental as well as economic impacts on the ratepayers. There is delicate balance between environmental impacts and economic impacts in every decision that the Commission makes. This is especially true in terms of the potential detrimental impacts to low income ratepayers and their ability to have access to safe and reliable energy.

As a Commissioner carrying out the mission of the Public Service Commission of Wisconsin, do you accept that to provide utility service in efficient and environmentally responsible manner the

Public Service Commission should act to significantly reduce the carbon pollution from the power sector in Wisconsin?

Wisconsin has made significant strides in reducing CO2 emissions from the power sector over the past 15 years. In fact, Wisconsin was among the first states to implement many actions EPA is just now considering in its proposal. For example, in 1999 Wisconsin became the first state to enact a renewable portfolio standard (RPS) without having restructured its electric utility industry. In 2005, Wisconsin increased the RPS to 10%. Our utilities embraced the challenge, achieving our statewide target of 10% renewable generation in 2013 – two full years ahead of schedule.

Wisconsin also was an early adopter of energy efficiency programs, having implemented a utility-funded energy efficiency and renewables program (known as Focus on Energy) since 2001. This initiative recently received EPA's 2014 Energy Star "Partner of the Year - Sustained Excellence Award" for its years of leadership in protecting the environment through superior energy efficiency measures. This program, combined with the state's early actions to promote renewable energy, resulted in more than 10 million tons of avoided CO2 emissions in 2013 – equivalent to a 20% reduction from 2005 emissions.

At the same time, Wisconsin also meaningfully reduced CO2 emissions from our fossil-fuel plants. Wisconsin's utilities are regulated by the Public Service Commission of Wisconsin (PSCW), which means they have been and continue to be incentivized to improve and maintain efficient fleets. As a result, over the past two decades our utilities have closed many older coal-burning plants, improved the efficiency of those remaining, and invested in cleaner natural gas facilities. In addition, they have constructed several of the newest, most efficient coal-fired plants in the nation. We take pride in the fact that we have been able to sustain a reliable base of electrical generation while simultaneously reducing emissions and improving the quality of our air.

2. Recent press reports have indicated that some state governments have sought to prevent state employees from using certain terms related to climate change in official communications.

To the best of your knowledge, has the Governor or any employee in his office sought to prohibit any state employee from using the terms "climate change," "global warming," or "sustainability" in your state's public or inter-agency communications about the Clean Power Plan or in any official agency communications?

No

Senator INHOFE. Thank you, Ms. Nowak. The end of your remarks answered the first question I was going to ask you, the problem that if you submitted a SIP in compliance with building block one, and yet they came along and say, no, we have to have a FIP, a Federal program for two, three and four, would that create a problem. I think you adequately answered that.

But very similarly, I would like to ask you, North Carolina proposed to delay the Clean Power Plan until a final ruling by the courts on the plan's many legal uncertainties. If you remember, during our budget hearing, the administrator of the EPA talked about, I think it was \$3.5 million to hire a bunch of new attorneys because of all the lawsuits and problems. I would ask you, in your State of Wisconsin, you could end up taking steps to comply with the Clean Power Plan that the State came back and found that it was ultimately out of compliance. So what kind of problem would that be for Wisconsin?

Ms. NOWAK. It creates a lot of uncertainty. As a regulator, the parties we regulate, ratepayers all want and deserve certainty about where rates are going to go and what we may do. When we become commissioners, they don't give us crystal balls. So unfortunately, we can't look into the future. But we have to make the best decision, based on the information before us.

We ran into a similar issue with the Cross State Air Pollution Rule, when it was hung up in the courts, and utilities were starting to make movements to attempt to comply. We have to do the best to allow them to try to recover. But we have to be judicious, obviously, in spending ratepayer dollars. So we will work closely and obviously monitor the legal proceedings and any legal proceedings that Wisconsin is involved in, so we don't unnecessarily spend ratepayer dollars.

Senator INHOFE. Mr. Easterly, in your written testimony you talked a little bit and elaborated a little bit more on how the Clean Power Plan proposal could actually increase, increase the cost. This is an increased amount of emissions, and this is a position that I have held ever since Lisa Jackson said that doing something unilaterally in the United States is not going to affect it. Because this isn't where the problems are, as you saw on this chart, with China.

Did you want to elaborate any more on that concept about that, could it increase instead of decrease emissions?

Mr. EASTERLY. Most of our businesses, the basic bottom of our economy, the steel industry, the auto industry, rely on energy costs. And they are internationally competitive. So you can buy steel from Brazil, you can buy steel from India, you can buy steel from Russia and use it. Actually, why would you bother to bring the steel to the United States? You just bring the finished product here.

So the emissions will happen in those countries. Some of those countries have decided to, I understand China signed an agreement to consider stopping the growth of their emissions by about 2030. But between now and 2030, those emissions, they are so much higher per unit of production than we have here. So as our businesses have to stay in business by being internationally competitive, I am very concerned that total emissions will go up.

Senator INHOFE. All right. Thank you very much.

Ms. Nowak, have you done an analysis as to how much of a rate increase would the PSC have to approve to implement this plan?

Ms. NOWAK. We expect it to be in the double digits, depending on which method of compliance we use. It could be easily into the upper 20 percent of an increase.

Right now, we have an aggregate number of a \$3 billion to \$13 billion for the State to comply. How that is eventually broken down on a per ratepayer increase is something that will be fleshed as we know more details and utilities come in and ask for recovery. But this is going to be a significant increase on ratepayers all across the board, low income to our large manufacturers.

Senator INHOFE. Thank you.

I am going to be asking you for the record, Mr. Myers, or if there is time at the end of my 6 minutes, if you would agree with the position that many have taken, that wouldn't it be better to wait until these controversial legal issues are cleared up before requiring them to comply? I hope we have time, because I do want to hear your answer to that.

So I would say to Ms. Nowak, Mr. Easterly and Mr. Parfitt, what parts of the Clean Power Plan will require enactment of new laws in your State, and how long would it take to develop, pass and implement these laws? Let's start with you, Mr. Parfitt.

Mr. PARFITT. Mr. Chairman, as far as legislation that may need to be put into place, anything that would relate to a multi-State plan, if there were to be one developed, would certainly need some legislative discussion. Anything dealing with a renewable portfolio standard, basically the building blocks three and four would likely require some sort of legislation.

Now, the timing of that, our legislature meets for a 40-day session and then a 20-day session. So, alternating. Our next session coming up is a budget session. So there are some timing concerns related to when something could be brought forth to the legislature in a meaningful way through an interim topic study as well.

Senator INHOFE. All right. Mr. Easterly?

Mr. EASTERLY. So, in Indiana, our legislature also doesn't meet year-around. So the next time they could consider things is 2016. We don't have authority for building blocks two, three and four. And then if I have to pass rules, we have an 18-month rulemaking process. We will be years out.

Senator INHOFE. Any further comment?

Ms. NOWAK. We have at least a 3-year rulemaking process on a controversial rule, which I would submit this would be one. And we would also have to change, we don't have authority over building blocks three and four. If we were to increase our RPS, or change our energy efficiency standards, those would all require legislative action as well, which adds to the timelines.

Senator INHOFE. Thank you. Senator Boxer.

Senator BOXER. Thank you so much.

What I am stunned by is some of the States' attitude of gloom and doom when we have States that are doing this prospering far more than your States. That is what kind of stuns me. But it is OK, I respect your view.

I want to ask Mary Nichols this question. When you listened to Mr. Easterly respond to my chairman, in where they said, well, ac-

tually, these rules could mean that we would be increasing carbon worldwide, because some companies will leave the States, they will be so upset at these rules. Have we found companies running away from California? Last I checked, Silicon Valley was booming. We have increases in manufacturing. Am I wrong on the point?

Ms. NICHOLS. You are not wrong, Senator Boxer. We have experienced growth across the board. But particularly in the clean energy sector in California, because of our policies. We are the leading State in terms of investment in clean technology, and also in renewable energy in the Country right now. Solar energy in particular is building.

Obviously we have some natural advantages in California in terms of renewables. And I think it is important to say that there needs to be transition time for all industries and all States. When we implemented our cap on carbon emissions with a trading program, there were many who were concerned about the rising costs of electricity to our manufacturing sector. It is a critical concern for everybody, along with reliability. No State, no Governor can afford to take risks with the lights going out in their State. That is job one. No matter how much we care about the environment or greenhouse gases, and we do, profoundly, we know that our job is also to make sure that the lights stay on.

So I think it is important to recognize that this proposal that EPA has put out does have within it the flexibility and the time that is needed. I recognize the concerns of my fellow States, and I think they are legitimate concerns. But I would assert that the proposal, as EPA has put it out, which admittedly they will be modifying as they go forward, can address those concerns.

Senator BOXER. I think that is such an important point. Because you make it very clear that we need transition time. And we started a little earlier. I think EPA does get that, Gina McCarthy does get that. She is very sensitive to the States.

Mr. Myers, I wanted to ask you, last year former EPA Administrator Christy Todd Whitman, who served under George W. Bush, testified before our Clean Air Subcommittee that it was settled law that the Clean Air Act can be used to control carbon pollution. Are EPA's proposed carbon standards supported by the three Supreme Court decisions in *Massachusetts v. EPA*, 2007, *American Electric Power v. Connecticut*, 2011, and *Utility Air Regulatory Group v. EPA*, June 23d, 2014?

Mr. MYERS. Yes, they are, Senator. The *Massachusetts v. EPA* case, as you may recall, recognized that EPA has the authority under the Clean Air Act to regulate greenhouse gas emissions. And the *Connecticut v. American Electric Power* case was a case that New York was involved in, where we sought to get the very same emissions that the EPA Clean Power Plan is going to get at. The Supreme Court in that case told us that Federal common law nuisance did not apply, because Section 111 speaks directly to these power plant emissions.

And with respect to the last decision, the UARG decision that you mentioned, the Supreme Court again reaffirmed EPA's authority under the Clean Air Act to regulate greenhouse gas emissions, and there found that under the Act's stationary source permitting program, if you are emitting a certain amount of conventional pol-

lutants, then you also have to apply the best available control technology for CO₂ emissions.

So I think all told, those decisions provide a sound foundation for EPA's Clean Power Plan.

Senator BOXER. Thank you, Mr. Myers.

Mr. Parfitt, last month the Chief Environmental Counsel at Berkshire Hathaway Energy, which owns a dozen utilities across the Country, including Rocky Mountain Power, a regulated utility serving Wyoming, stated about the State's compliance with the Clean Power Plan, and I would like to get your reaction to that, "If the State wants to push back against the plan, that is OK. But we really do have to have a backup plan, because if not, we will be caught in a situation where we don't have any option, and that is the worst of all positions to be in."

She also stated the Clean Power Plant's 2030 targets are achievable and urged Wyoming to collaborate with other States to meet them.

Do you agree with Rocky Mountain power that Wyoming would be best served by completing a State compliance plan?

Mr. PARFITT. I can't speak specifically to the comments of Rocky Mountain Power. But what I can say is that our evaluation, when we look at the entirety of the plan, it doesn't work for Wyoming. Because as shown in the charts that we displayed, the options, the building blocks as presented by EPA in the proposal don't work for Wyoming. So we would say that no, the plan doesn't work. We have more than one utility within the State.

Senator BOXER. I totally appreciate that. Last question. Have you told EPA your concerns and have you given some options to the EPA? Because they really want to work with the States. Have you let them know how you feel and specifically what is wrong with what they are doing for Wyoming?

Mr. PARFITT. Yes, we have provided comments from both the DEQ and Public Service Commission, and have had discussions since the comment period.

Senator BOXER. Good. Thank you.

Senator INHOFE. Thank you, Senator Boxer. Senator Rounds.

Senator ROUNDS. Thank you, Mr. Chairman.

During the time that we were on the campaign trail this last year, and I am new to the committee and new to the process up here, one of the items that we talked about a lot was the anticipated cost to the average American family with regard to an increase in their costs for electric rates. The United States Chamber of Commerce, last summer, I believe, estimated the average cost to the average American family to be approximately \$1,400 more per year in their electric rates.

I was curious, Mr. Parfitt, in a recent statistic that comes in the case of my State, South Dakota, that our electric rates would increase probably about 20 percent or more as a result of the Clean Power Plan, this is significantly than the 8.8 cents per kilowatt hour that South Dakotans pay now. According to the Wyoming Public Service Commission, compliance costs for the 111(d) proposal could well exceed \$50 per ton of carbon.

What impacts will this have, not only on ratepayers in Wyoming, but also on ratepayers in surrounding States? I know that people

in South Dakota receive power from Wyoming. Wyoming, as you indicated earlier, supplies power, because of your location to the natural resources available, you are an exporter of power. Could you share a little bit about what effect this will have on the rates for people in the other States as well?

Mr. PARFITT. Yes. We do provide power to many other States. If our compliance path, as we have viewed it, based on the proposal, results in the premature closure of plants and the stranded assets, it would likely result in raising of rates for all the customers, not just those in Wyoming. It would be shared across the network.

Senator ROUNDS. What does the EPA propose or how does the EPA propose that you respond to those stranded costs? What is their expectation?

Mr. PARFITT. This is an issue that we had raised with EPA before the proposal was put out to notice, in hopes that would be taken into consideration. In our view, that hasn't been taken into consideration and we don't see, at least at this point, the off ramp. We have expressed this concern to EPA in our comments. So we are waiting to see how they might respond in June when they come out with the final proposal.

Senator ROUNDS. So you have not had a comment back, or there is not a process within this to get a response back for the stranded costs that you have indicated our State would have, and would have to pass on to other States that also expect the electricity or the places where your organizations have contracts with them to provide ongoing electric power, those stranded costs? You don't know how those would be handled?

Mr. PARFITT. At this point, EPA has not conveyed to us how they would address that particular comment. The conversations that we have had with EPA have been primarily to get clarification on some of the corrections that we pointed out within the proposal itself.

Senator ROUNDS. The EPA claims that the rules give States flexibility to create their own plans. But it appears that it overlooks the fact that electricity transmission does not stop at State borders. Many States, including South Dakota, depend on neighboring States to help support their own electricity generation and ensure the reliability of the grid. EPA's modeling suggests that under the 111(d) proposal, Wyoming could cut its generation by 7.5 million megawatts, or million megawatt hours. How will you continue to power the regional economy with cuts like this, and is that an accurate statement?

Mr. PARFITT. As far as how we would continue, if we were looking at closing down existing power plants, that would create a reliability issue. However, this is getting a little bit out of my expertise, within the expertise of the Public Service Commission in terms of how to maintain the reliability of service to all of its customers.

Senator ROUNDS. Thank you, I appreciate your time. Mr. Chairman, I yield back.

Senator INHOFE. Thank you, Senator Rounds. Senator Carper?

Senator CARPER. Thanks, Mr. Chairman.

To each of you, welcome. I am glad to see you. Thanks for what you do and thanks for sharing your thoughts with us and responding to our questions.

My colleagues know I come before many of these issues not as a sitting Senator but as a recovering Governor. I want to share with you a little bit of a perspective from the little State of Delaware, from a guy who was born in West Virginia, a guy who was a coal miner for a little bit of time. So I come with a lot of different perspectives.

When I was Governor of Delaware, I could have shut down the economy of my State in order to try to be in compliance with the clean air standards. And we would have been out of compliance. The reason why is the folks who were creating cheap electricity to the west of us, some of them put bad stuff up in the air and it came our way. We are at the end of America's tailpipe, similar to Maryland, Pennsylvania and New Jersey, New York.

I am a big believer in the Golden Rule, treat other people the way I want to be treated. The concerns that you are laying out here for us today, I think they are important concerns and we have to be mindful of them. I get it. EPA needs to be mindful of them as well. But I just want you to know that there are other folks who have been adversely affected by the ability of some people in our Country to develop cheap electricity, dirty electricity, and we suffer the consequences. I don't like it. We haven't liked it. We tried to go to court to resolve that and we finally have succeeded in doing that.

I want you to get in a car with me, use your imagination. We're in southern Delaware. We are driving on Prime Hook Road to the east, to the Delaware Bay. We get to the Delaware Bay. There used to be a parking lot there, a big parking lot there. It is not there anymore. Well, actually, it is; it is underwater. You look off to the right, you will see a bunker sticking up out of the water, about 500 feet out. That used to be about 500 feet on the land, now it is 500 feet out in the water.

Something is going on here. We can't just make this stuff up. And the key is for us, is how can we have cleaner air, how can we address the issues of rising waters? Delaware is the lowest-lying State in the Country. It is a real problem for us. And in order for us to address this, we need to figure out how to do it together. I am not interested in seeing EPA jam anything down your throats. But we need to figure out to work on this together.

One of the issues is, why are we creating a lot of electricity? It sounds like you export a lot of electricity. My understanding under the rules that are being contemplated here, you don't get a lot of credit for that. And the credit, I guess, goes to California and those other States. We have to be able to figure out how to deal with that. We ought to be able to use some common sense in figuring out how to deal with that.

I want to ask a question of the lady from California. It sounds to me like your economy is doing pretty well. And the question of can you have a cleaner environment and a stronger economy, I think you have answered that. We think the answer is yes, you can. I think it is a false choice. I think most of you at this table would agree with that.

There are a couple of things the folks from California, you are in a situation where you acted early, you have been a good citizen, a good steward. And my sense is you are going to be punished for it, if we are not careful, by EPA. We are in the same situation. We don't like that. What do you think we should do about it?

Ms. NICHOLS. I think your comment earlier about States needing to work together is exactly correct. To my friend from Wyoming, my local utility, the Los Angeles Department of Water and Power, just concluded a very large agreement with a Wyoming wind company to import wind-generated electricity from Wyoming to help replace some of the coal-fired energy that they have been relying on. They are actually taking responsibility for being the largest emitter in our State, even though the electricity that we were using was coming from Utah, as it happens. And there will be costs associated with transitioning away from the coal and into the wind.

But overall, the net of it is that Los Angeles ratepayers will still be doing OK, because the utility is taking steps to help their customers become more efficient in their use of energy. That I think is kind of the critical ingredient here, that if our rates go up because of new investments that we are making, that has to be offset in order to shield the ratepayers from rate shocks and from things that would just make it untenable for them to move forward on this cleaner electricity plan that we are on.

But given some time for the transition, we can do it. I do think that it was right to come up with a crediting mechanism. I think EPA needs to do this if they want to encourage regional cooperation as they say they do. They are going to have to allow States to work together on either a bilateral or regional basis to come up with programs where they can effectively share the cost and the benefits.

That is what we are doing right now through our agreement with the Canadian province of Quebec, where we now run literally a bi-State, bi-national trading program with emissions allowances. Obviously, not everybody is going to want to go that far afield. But the concept, I think, is one that has been proven to work.

Senator CARPER. Thanks. Very briefly, can each of you just give me what you think is a fair compromise to the issue of Wyoming generating all this clean electricity by wind and shipping it off to California and other places, not really getting the credit for it? It sounds like the credit, as I understand it, goes to California or the other States that are the customers. What is a fair way to deal with this? What is a fair compromise? Ms. Nowak, very briefly.

Ms. NOWAK. I didn't fully understand your question.

Senator CARPER. Mr. Parfitt, can you try to answer this? It certainly pertains to you.

Mr. PARFITT. As it pertains to the Clean Power Plan, I think there are two issues, or actually three issues at play. The first is the attribution of fossil fuel emissions, CO₂ emissions, being attributed 100 percent to the energy-producing States.

Senator CARPER. Right.

Mr. PARFITT. The other issue that is at play here is the renewable energy that is generated in Wyoming, which most of it, 85 percent of that, is shipped out of State.

Now, applying an escalator to that, 100 percent of that to the producing State, is unfair and I think it is a disadvantage.

Senator CARPER. Mr. Chairman, I will say this. We have to figure out a good compromise here, and you all have to help us. Thank you.

Senator INHOFE. Thank you, Senator Carper. Senator Capito.

Senator CAPITO. Thank you. I would like to thank the panel, thank the Chairman and Ranking Member.

Let me just say a few words about my home State of West Virginia and what we have had to say about the Clean Power Plan. Our own DEP has called it patently illegal, invading the province and it has been put forward with the finesses of a bull in a china shop. I would note in the comments that 32 States have submitted negative comments, or comments of great concern to this rule, while the numbers that have submitted comments in support are much, much smaller in terms of States.

But I want to talk about the reliability issue. West Virginia has joined with other States, probably several of yours, to block this plan, and we will be hearing this suit in the next several months. And the DEP in West Virginia has said that these goals are unattainable. We have heard some testimony to that.

With that in mind, I would like to talk to Mr. Easterly, because we have a lot in common in terms of your production of your electricity, predominantly with coal. We have 95 percent of our electricity is generated by coal, for obvious reasons. We have a lot of coal, although not as much as Wyoming.

So EPA has indicated that it does not have any significant concerns about reliability with this rule. Yet last week, PJM Interconnection released a new analysis that found that the Clean Power Plan could trigger up to 49 gigawatts of generating capacity in jeopardy. Let me just quantify, 49 gigawatts is the equivalent of the electricity that is used to power 50 million homes. This is one of the studies that was recently released that I think calls into question the reliability issue.

Are you concerned about reliability in Indiana? I would note that Ms. Nichols did mention the reliability issue as a very important one for the State of California. I would like to hear your comments on that.

Mr. EASTERLY. Yes, we are. We have another group that deals with the reliability. But here is our fundamental problem. The plan, even in EPA's best thought process, has significantly more fossil fuel-fired reductions by closure than it does new generation of renewable and wind and other things. So the plan necessarily will reduce the flexibility of our electric supply in the United States. You add this to the fact that we have had record PJM demand days, they are a little better handled this year than they were last year under the polar vortex. And we are in PJM and MISO.

So we have increasing demand, we have decreasing supply. And the renewable supply is valuable, but it is not reliable. So sometimes the wind is blowing, sometimes it is not. Sometimes the solar panels don't have clouds or snow on them and sometimes they do. So you can't count on them for either thing, for their nameplate ca-

capacity is much higher than their actual generation. And they are not always available when you need them.

So I am very concerned, as are a lot of people in the industry, that we will see some catastrophic result some time during the implementation of this plan. We just don't know where or when.

Senator CAPITO. Ms. Nowak, do you have a comment on that, the reliability issue?

Ms. NOWAK. Certainly. We have some significant concerns. From the perspective of system reliability, the modeling program used by the EPA to evaluate the building blocks and whether the goals are actually achievable uses less robust data than possessed and used by our own RTO, MISO. And so they are responsible for maintaining our grid. Unfortunately, the EPA never asked MISO to do any studies of the grid prior to releasing this proposal.

Examples of the work that we think needs to get done includes gathering information about firmness of the interState pipeline deliverability for gas-fired units, plans for replacement of units, the impact on the increase of intermittent renewable resources on reliability, and considering the electric grid location and network deliverability of units to be expected to be retired. Again, the modeling used by the EPA doesn't appear to consider any of these very fundamental and necessary factors. So we are concerned.

Senator CAPITO. I would note in my State we are heavily reliant on coal for obvious reasons. But we also have a lot of natural gas. But to transition these older plants to natural gas is just not a realistic endeavor. It is exceedingly expensive. And to build new ones takes a lot of time and a lot of energy. You are going to expend energy to move forward on this as well.

You have also just recently closed one of your nuclear plants in Wisconsin. And your plan that was put forward for you under this Clean Power Plan does not take into consideration your loss of nuclear power. That has to be a problem for you, too, in terms of meeting this challenge. Would you make a comment on that?

Ms. NOWAK. Sure. The loss of that plant is huge for Wisconsin. We think that eventually that is going to have to be replaced with a carbon neutral source. That was not taken into account, and that will increase the cost of this proposal for Wisconsin to comply.

Senator CAPITO. Ms. Nichols, let me ask you a quick question. We had a hearing last week on ozone and the new regulations that are going to be put into effect. Is every county in California compliant with the current ozone regulations that we have presently?

Ms. NICHOLS. No, Senator, we are not. We have remaining challenges in both Southern California and in the Central Valley meeting the ozone standards. And the new ozone standard will add an extra challenge, as well as some extra time to that effort.

Senator CAPITO. So you put that on top of what we are doing here with the Clean Power Act.

Ms. NICHOLS. We care about the health of our citizens, Senator.

Senator CAPITO. I care about that as well.

Ms. NICHOLS. We rely on the science.

Senator CAPITO. In terms of how we are going to meet this challenge, in terms of our timelines, extension of timelines, extension of measures? What is going to be the best, Mr. Parfitt, for Wyoming? What is going to be the easiest thing to knock down on this

Clean Power Plan that is going to make the biggest impact for you to be able to meet the challenges? Deadlines, timelines? Lower standards, less reductions?

Mr. PARFITT. Certainly timelines are a big component of this when you consider developing a plan and the time involved with that and the complexities and the amount of agencies and States that would have to be involved in that discussion, let alone the legislation and rules that we have already mentioned here and the time that would take would seem to be very problematic.

Senator CAPITO. Thank you.

Senator INHOFE. Thank you, Senator Capito. Senator Merkley.

Senator MERKLEY. Thank you very much, Mr. Chair.

Underlying this entire discussion is the challenge we have with carbon pollution, methane pollution and the impact it is having across the world. But we don't have to look across the world, we can look to my home State of Oregon. And indeed, we are seeing that the fire season has grown by 60 days over the last several decades, and the number of acres of forest that has been burned has increased dramatically. We have an oyster industry that is having great trouble because the baby oysters have trouble forming shells because the ocean is 30 percent more acidic than it was before the Industrial Revolution.

We have a farming community that is suffering significant, repeated, worst ever droughts because the snow pack in the Cascades is steadily declining. And this year is one of the lowest ever. While rain earlier in the year can fill a reservoir, if you don't have the snow pack, come August, you are in trouble.

So as we see this impact on farming and fishing and forestry, right now, we are not talking 50 years in the future or 100 years in the future, we are seeing it right now, just like Delaware. Senator Carper was talking about land that is now underwater. Should the entities that are being damaged by carbon pollution be able to sue those who are generating the carbon proportional to their contribution? Mr. Easterly?

Mr. EASTERLY. I am not a lawyer, so I can't answer should somebody be able to sue. But remember that the environment of our earth has been changing for all of recorded history. Indiana used to be under a huge ice sheet. There are natural variations. And the things you talked about, some scientists would say, are due to the Pacific Decadal Oscillation. And they are likely to continue causing harm for the next 20 years.

Senator MERKLEY. Thank you, Mr. Easterly. Mr. Parfitt, would you like to answer?

Mr. PARFITT. I would echo those comments. This is a legal question and I am not an attorney that can address that.

Senator MERKLEY. OK, a legal question. But the principle, you understand, of polluter pays, when you do some damage to your neighbor, shouldn't you bear some responsibility just as a basic fundamental principle?

Mr. PARFITT. I think this is a complicated question. You have users who may have some responsibility as well. So from a legal standpoint —

Senator MERKLEY. OK, you don't want to answer the question. That's fine. Ms. Nowak.

Ms. NOWAK. If the utilities and entities are following existing law and regulation, I would think it would be a very chilling effect to have them subjected to legal claims.

Senator MERKLEY. OK, well, everyone in their first year of economics learns about externalities, things that are not reflected in the market, damage done by activities, certainly our libertarian friends would say, when you do damage to your neighbor, you should compensate for that damage. The fact is, carbon is produced and methane is produced in a million different ways. There is no State that doesn't produce a lot of both.

But we are seeing a differential in how States are taking this on. Oregon, now, about 70 percent of its electricity is produced in non-fossil format. And Ms. Nichols, you were referring to a 2020 goal of one-third. But that didn't include your hydropower, I believe. What is it with hydropower included?

Ms. NICHOLS. If we included the hydro that we receive, we would be already at above our 30 percent, 33 percent goal. So we chose not to add it, or the legislature chose not to add it or nuclear, because they were trying to really push for new solar, wind, geothermal and biomass energy.

Senator MERKLEY. Right. Say what that percentage would be again if those things were included, the other non-fossil. If you include the other non-fossil.

Ms. NICHOLS. It would be about 40 percent.

Senator MERKLEY. Forty percent.

Ms. NICHOLS. Yes.

Senator MERKLEY. Well, you have to aim for Oregon, where it is 70 percent. We are shipping a lot of wind power out.

Ms. NICHOLS. We envy Oregon.

Senator MERKLEY. And we often respect greatly the examples that you are setting, particularly here is, you have set up a marketplace. Now, if we turn back in time, there was a proposal that came really from right wing think tanks about using markets to regulate sulfur dioxide to take on acid rain. And the concept was not to regulate every smokestack, but to proceed to set up the marketplace and therefore the most cost effective solutions would be adopted. How did that work out? Do you have a memory of that?

Ms. NICHOLS. Senator, I was the assistant administrator at EPA when we implemented the acid rain trading program. I am very proud of the success of that program. It did reach its goals in terms of the amount of sulfur dioxide that was reduced, and it did so less expensively. We relied on that plan in designing our cap and trade program in California.

Senator MERKLEY. So the marketplace for sulfur dioxide worked extraordinarily well, actually, lower costs and faster results than anyone anticipated. It was really an off the chart success, and congratulations. Why wouldn't that same strategy work well in carbon dioxide?

Ms. NICHOLS. Well, we believe it would. It was, as you know, defeated here, but within California it was actually put on the ballot and the voters chose to keep that system in effect. Because I think they became convinced that it would lead us to a cleaner future.

Senator MERKLEY. It was, you see carbon dioxide reduced in the most effective manner, to achieve similar off the chart positive results.

Ms. NICHOLS. Yes, sir.

Senator MERKLEY. And isn't the Clean Power Plan really based around that same core principle of States developing their own plan through a range of different choices of how to address carbon? Not quite a cap and trade, but that is a possibility that the State could employ.

Ms. NICHOLS. It is clearly allowable. It is not required. I know that EPA was very familiar with our program when they designed the rule. But I also understand that they tried really hard, it doesn't seem like they have quite succeeded just yet, anyway, to indicate to States that they would have the ability to design a plan that fit their own unique situation.

Senator MERKLEY. Thank you very much.

Senator INHOFE. Thank you, Senator Merkley.

Senator Barrasso would be next, but he has graciously conceded to let Senator Boozman go ahead.

Senator BOOZMAN. Thank you very much. Again, just for a second, but I appreciate it.

Ms. Nichols, following up on Senator Merkley's question, you are out of compliance for ozone. And the EPA's regulatory impact analysis says the annual cost to California alone would be \$800 million to \$2.2 billion per year. Do you feel like individuals should be able to sue you for non-compliance?

Ms. NICHOLS. Under the Clean Air Act, citizens have the ability to sue EPA, or indirectly, the State, for non-compliance with any element of a SIP. California has submitted a State Implementation Plan and we are in compliance with our plan. We are moving forward steadily every year, bringing down our levels of ozone. And we have actually come into compliance in many counties.

Senator BOOZMAN. So your argument, then, is the same as Ms. Nowak's in the sense that if you are doing things as required by law, then you shouldn't be sued?

Ms. NICHOLS. One of the reasons why we are here to defend the carbon plan, the EPA plan, is that it helps us with our ozone standard as well. We need all the help we can get.

Senator BOOZMAN. But in regard to the question, you agree with Ms. Nowak in the sense that if you are in compliance with what the regulation requires, you shouldn't be sued?

Ms. NICHOLS. Mr. Boozman, I went to law school, too, and we were taught that anybody can file a lawsuit.

Senator BOOZMAN. I didn't go to law school.

[Laughter.]

Ms. NICHOLS. Anybody can file a lawsuit and sometimes they win.

Senator BOOZMAN. I guess what I am saying, what she is saying is, that really would wreak havoc in the sense, there is no way that you are going to be—when do you feel like you are going to be ozone-compliant?

Ms. NICHOLS. At this point, we are projecting off into the future, we are working as hard as we can, but it will probably be as challenging, it not more challenging, to meet the ozone standard as it

is to meet the greenhouse gas standard. That is exactly why we are supporting the EPA rule, because it will help us with both.

Senator BOOZMAN. Do you agree it will cost you \$800 million to \$2.2 billion a year?

Ms. NICHOLS. I can't verify that number. I would say, though, that the economic analysis that EPA did in advance was using all the tools that we would have used in the same way.

Senator BOOZMAN. Good. Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator. Senator Whitehouse.

Senator WHITEHOUSE. Thank you, Chairman, and thanks very much to the panel for being here.

Let me ask first, Commissioner Nowak, in 2013, Commissioner Nowak, the Milwaukee Journal Sentinel published an editorial in your home State that said, "Climate change is happening. Human activity plays a huge role in that. The consequences of doing nothing could be dire and expensive." Do you agree with the Milwaukee Journal Sentinel on that?

Ms. NOWAK. Thank you for the question. My role as a regulator or an economic regulator, we ensure also the reliability of the grid, I did not or do not endeavor to take on the policy behind what is before us. My role here has been analyzing it and rules that come before us. I look for three things. An environmental rule is coming; does it compromise the affordable, the safety and reliability of our grid. That is the lens that I look through this rule.

Senator WHITEHOUSE. No amount of environmental cost would figure under your analysis, then?

Ms. NOWAK. No, that is not what I said.

Senator WHITEHOUSE. That is exactly what you said. I am just trying to make sure that you put it properly and want you to explain further.

Ms. NOWAK. No. The environmental rules cannot unduly compromise the reliability of the—

Senator WHITEHOUSE. No matter how great the environmental cost?

Ms. NOWAK. There is a balance that needs to be struck.

Senator WHITEHOUSE. How do you strike that balance if you don't know whether climate change is happening and whether human activity plays a huge role in that and whether the consequences of doing nothing could be dire and expensive, which I assume dire and expensive are words that would fit into that calculus?

Ms. NICHOLS. We look at what the impact on our ratepayers would be and the benefits to the environment under the proposed rule.

Senator WHITEHOUSE. But the impact on your ratepayers could be felt through climate change as well as through just the rates that they pay, could they not?

Ms. NICHOLS. Those are —

Senator WHITEHOUSE. That is not a part of what you looked at? That is not part of your analysis?

Ms. NICHOLS. The benefits have been put forth by the EPA in their plan. And we are weighing the costs against the benefits that the EPA has proposed.

Senator WHITEHOUSE. For what it is worth, the Executive Director of the Wisconsin Business Alliance has called renewable energy an economic opportunity for Wisconsin that will “result in business growth, job creation, cleaner air and a quicker path to energy independence.” She recently said, “We should look for opportunities to promote jobs and the environment and the Clean Power Plan is a great way to do that.” So there appear to be other voices from Wisconsin.

Mr. Parfitt, Rocky Mountain Power’s owner, the spokesperson for Rocky Mountain Power’s owner, has said that multi-State approaches are likely to be a less costly way to meet the Clean Power Plan’s targets. Wyoming’s Casper Star-Tribune has said that, the Montana officials have held earlier discussions with other States about the prospect of cooperating to meet the EPA’s targets consistent with the multi-State approach that Rocky Mountain Power’s owner referred to.

Their Wyoming counterparts, the Wyoming Casper-Star Tribune continued, have thus far rejected regional advances. Now, Montana, which is also a rural State that generates a significant portion of its electricity from coal, has come up with five draft options for complying with the proposed standards, including options that would not require Montana to shutter its coal plants.

So if Montana can do this, why can’t Wyoming? And if Montana will work with other States, why won’t Wyoming?

Mr. PARFITT. First I will address Montana’s five different alternatives. In their alternatives, they assume that they will get credit for 100 percent of the wind energy. And that is not what has been conveyed by EPA. We have been told that we will get no credit for wind energy that is consumed outside the State. So that is one difference.

As far as the multi-State discussions, I will say that we have been involved with the same group, the Center for New Energy Environment, and participating in those conversations along with Montana and 13 other States. Now, there are challenges with a multi-State plan, particularly when we don’t know what the end goal is going to be. All we have right now is what has been proposed. We don’t know how EPA is going to change that proposal based on the comments that have been received.

So we don’t know what the targets are going to be.

Senator WHITEHOUSE. Do you agree that climate change is happening, that human activity plays a huge role in it and that the consequences of doing nothing could be dire and expensive?

Mr. PARFITT. I am here to talk about the Clean Power Plan and whether or not we are going to do something to address CO₂ emissions, whether or not this is a good plan and is it workable for Wyoming. And the answer is, it is not workable for Wyoming.

Senator WHITEHOUSE. Irrespective of the amount of damage that CO₂ might do? There is no number from CO₂ harm that could cause you to change your point of view on that?

Mr. PARFITT. Not on the proposed plan and what that does to plants.

Senator WHITEHOUSE. Very well. And finally, Mr. Easterly, how have you built the costs of climate change for Indiana into your analysis of the value of the Clean Power Plan?

Mr. EASTERLY. I don't think you can quantify any cost of future climate change on the State of Indiana. Let's go back to your other question.

Senator WHITEHOUSE. Why do you not think you can quantify it? Isn't that part of your job?

Mr. EASTERLY. There is nothing concrete to quantify. There is speculation.

Senator WHITEHOUSE. Have you read the report that says that 8 to 23 percent likely increase in energy costs could come to Indiana?

Mr. EASTERLY. The energy costs refer to the Clean Power Plan, yes.

Senator WHITEHOUSE. No, this is not from the Clean Power Plan. This is from increased heat levels in Indiana requiring increased cooling load during the—you are not familiar with that report, obviously?

Mr. EASTERLY. Not that one.

Senator WHITEHOUSE. OK. When you are talking about the cost of electricity, are you talking about on a per kilowatt hour basis?

Mr. EASTERLY. Yes.

Senator WHITEHOUSE. Let me just say, I am sorry to go over, can I just make a Rhode Island point?

Senator INHOFE. How long is the Rhode Island point?

Senator WHITEHOUSE. Less than a minute.

Average monthly bills of residential customers in Wisconsin are \$95.21, in Indiana they are \$110.44, and in Wyoming they are \$90.85. In Rhode Island they are \$91.48, lower than two of these States, even though our kilowatt hour costs are higher. Because we have invested intelligently in energy efficiency and is that figure that really matters at the pocketbook.

Senator INHOFE. Thank you, Senator Whitehouse. Senator Barrasso.

Senator BARRASSO. Thank you very much, Mr. Chairman. First to Ms. Nowak, it is affordability, reliability and safety, are those what you consider?

Ms. NOWAK. Correct.

Senator BARRASSO. Thank you. Mr. Parfitt, just to kind of review, when it comes to how the EPA credits renewable energy, Wyoming, which produces a significant amount of renewable energy, still stands to be severely disadvantaged. You talked about how much Wyoming produced in terms of wind energy. I think you said that 85 percent of Wyoming's wind energy is exported to a number of other State. I heard Chairman Nichols say that California wants to buy even more Wyoming wind energy.

But the EPA has said no, that renewable energy is going to only be credited to the State where it is consumed, not where the energy is created, the hosting State, which means that Wyoming gets absolutely no credit for most of the wind energy that it develops. So I appreciate Senator Carper saying that needs to be addressed.

My question is, how is this going to impact Wyoming's ability to attain our emission target? And how much additional renewable generation would we have to develop just to meet the EPA's proposed target?

Mr. PARFITT. This makes it very difficult for Wyoming to achieve its target. The estimate of renewable would be somewhere around 9 million megawatts of wind energy that would have to be developed in order for us to meet our target. Right now Wyoming consumes about 600,000 megawatts of wind energy. So that equates to about a 1,400 or 1,500 percent increase of renewable that Wyoming uses right now.

Senator BARRASSO. And you mentioned a lack of flexibility from the EPA in giving Wyoming what we would need in order to continue to produce a lot of the renewable sources. You mentioned that more than half of the land in Wyoming is federally owned, that this has a significant on meeting the mandates coming out of the EPA. Your reference to permits, to the NEPA process, to the ESA requirements for which Wyoming has absolutely no control, and it doesn't seem the EPA is proposing any sort of relief in the plans to address these. You specifically cited that only one-sixth of the total area that the EPA has identified for wind energy development is actually available for wind energy development, due to sage grouse considerations, permitting requirements.

It seems the EPA is telling people in Wyoming to move faster in renewable energy while refusing to acknowledge that Washington's foot is still on the regulatory brakes. So can you go into a little more detail about how Federal land ownership in Wyoming and the red tape that goes with developing energy resources on that land is a Washington roadblock that the EPA ought to address, if they want Wyoming to develop cleaner energy faster?

Mr. PARFITT. Yes. What we have seen for wind energy projects, when you have to go through the NEPA process, or those projects go through the NEPA process, that they have taken anywhere from four to 8 years to get approved through the NEPA process. Then there is an additional Fish and Wildlife Service process for eagle take permits. Those will add to the time involved.

The other piece of it is transmission. You have to have transmission to move the energy out of the State. Those right now, we have two projects that have taken up to 8 years to get through the permitting process. And they are still in that process now.

Senator BARRASSO. And we had previous discussion and debate and votes, actually, in the Energy Committee, about transmission lines under the Democrat-controlled Senate in the past. And Democrats specifically voted to block transmission lines on the public lands, which half of the Wyoming land is public land. So that I think actually has played into exactly what you are talking about as well.

Mr. PARFITT. That is correct.

Senator BARRASSO. You also talked about the potential closure of four coal-fired power plants in Wyoming, over \$1.4 billion, according to the Wyoming Public Service Commission. That is lost investment. And who knows how much it will cost to replace the lost power.

Of course, that is going to be passed on, I would assume, to citizens within the six-State territory of Pacific Corps. And Senator Whitehouse asked a specific question about Pacific Corps. So would that mean that folks in not just Wyoming, but California, Washington State, Oregon, Idaho and Utah are all going to get a big new

energy tax increase because of what the EPA is trying to do in closing those four power plants in Wyoming and having to build new plants? Am I correct in characterizing what you are saying?

Mr. PARFITT. That is correct. Those costs would be distributed amongst all the States involved with that system.

Senator BARRASSO. So California would have higher electric bills as a result of the EPA mandates here through that Pacific Corps.

Mr. PARFITT. There is a portion of Northern California that is part of that system.

Senator BARRASSO. A growing number of States are raising concerns that any type of implementation plan worked out with EPA is immediately going to become federally enforceable, making a State vulnerable to sue and settle lawsuits between environmental groups and the EPA. But unlike most sue and settle arrangements, which deal with a single plan or single facility under EPA's Power Plant rule, a States entire electricity system could become subject to environmental lawsuits. EPA actually agrees with this concern. During question and answer in an event in February, the EPA's Acting Air Administrator, Janet McCabe, says she sees potential for States being subject to third party lawsuits if they submit State implementation plans. We have heard it from the Texas public utilities commissioner as well.

Mr. Chairman, I would like to, if there is time to ask a couple of folks here, maybe the first three in the panel, if so, do you believe EPA can promise some sort of protection against these lawsuits? What are you seeing, Ms. Nowak?

Ms. NOWAK. We think the very foundation of this proposal already intrudes upon States' rights. And to have any State plans subjected to Federal authority is a great concern of ours. I think State energy policy should be left up to the States and in conjunction with the Department of Energy, not set by the Environmental Protection Agency. So we have great concerns about losing any State authority over any of our existing laws.

Senator BARRASSO. Mr. Easterly.

Mr. EASTERLY. We do not believe EPA can protect us from lawsuits under the Clean Air Act. They can happen and they do.

Senator BARRASSO. Mr. Parfitt.

Mr. PARFITT. We don't believe that we can be protected from the lawsuits from third parties with a State plan, as the proposal has been written.

Senator BARRASSO. Mr. Chairman, I am out of time. Thank you very much.

Senator INHOFE. Thank you very much. Senator Fischer.

Senator FISCHER. Thank you, Mr. Chairman, and thank you all for being here today.

Commissioner Easterly, when we had the Acting Air Administrator Ms. McCabe here earlier in the year, I asked her some questions about the heat rate efficiency assumption for building block one. And we know that EPA relied on the Sargent and Lundy analysis for that 6 percent heat rate. And in their own terms, they said that the EPA misapplied the data in a cumulative manner inconsistent with how the study was conducted.

Do you have any other concerns with how the EPA developed that 6 percent heat rate assumption that is out there?

Mr. EASTERLY. Yes. Part of EPA's thought process for building block one assumed that you would operate the plants in a way that gained efficiency, which really means you have to operate them at a steady State output. But then we have building two, which says, but oh, your coal plants are the last resort. You must operate your combined cycle natural gas plants first and use the coal plants to make up for swings in renewable and gas, and that will just make it much worse.

There is also emission controls that you have to add on to the coal plants, which have good reasons to be there. But they all decrease the efficiency of the plant because this rule is based on megawatt outputs and there is a huge parasitic load for controlling those emissions. So there is a bunch of reasons that the plants are going to be less efficient on a per megawatt hour basis than more efficient.

Senator FISCHER. So do you think that improvement is achievable in your State?

Mr. EASTERLY. We are hoping, and hoping is a strong word, that we might be able to get 2 percent if everything was done that could be done. But it is a serious challenge, because anything that is cost-effective, you have a reason to do it anyway if you are the utility, because you make more money. So the things that are left will only be cost-effective because the cost of not doing them under this plan is more expensive than the little incremental thing you will get.

Senator FISCHER. That is exactly right. Would compliance with other environmental regulations, would that have any impact on your State's ability to meet that 6 percent?

Mr. EASTERLY. It will, because we still have some utilities that are going to have to add more energy for NOx and SO2 reductions that aren't there now. So that will decrease their efficiency as it is calculated under this rule.

Senator FISCHER. I support an all of the above energy policy, and I know that many of my colleagues on this panel also support that all of the above, that we need to have a balance in our energy portfolios. I think that is extremely important for a number of reasons, security reasons, cost reasons. It is the wise thing to do.

Do you think that this Clean Power Plan encourages diversity within our energy sector?

Mr. EASTERLY. Not in the long run. In the long run, it basically is the plan to continue to shut down coal-fired power plants and have natural gas and renewables. And those are fine sources of energy, but if you have ever been in business, once you get close to a monopoly, you have pricing power. And that gas suddenly won't look like it does now in price. When I worked in the utility industry for a short period of time, we had a natural gas price spike. It was very disruptive to all of our customers.

So I am worried those are going to happen in the future.

Senator FISCHER. Let me go to another panelist, then I will ask another question. Mr. Parfitt, do you think that we are encouraging States to look at a balanced portfolio when it comes to their energy needs with this plan that is before us now?

Mr. PARFITT. From our view, the answer would be no. It seems like the purpose is to go to redispatch of other types of energy

sources to replace coal. So it is not looking at a mix, it is really aimed at reducing coal.

Senator FISCHER. I am from the only public power State in the Country. In Nebraska, we rely on our public power. It is a strength for our State. It is a definite strength for our ratepayers. We are very concerned about the impact it is going to have on families across our State, when and if this plan is implemented. Because we rely on our coal-fired electric plants. We have diversified portfolios, we continue to develop those. But to have a requirement, a mandate to have those implemented, I think in an unreasonably short period of time, will affect families and it will affect our most needy families.

Mr. Parfitt, how do you view that in Wyoming? You are our neighbors to the west. How do you view that? How are your families going to see what is coming to them?

Mr. PARFITT. We share the same concerns in terms of what the proposal will do to utility rates. Particularly with our compliance pathway as we see it, we would see an increase in rates due to the premature closure of coal plants and the stranded assets associated with that.

Senator FISCHER. And Ms. Nowak, in Wisconsin, I don't know what your energy portfolio looks like in your State, but I would assume that some of your ratepayers won't be pleased when they get their bills?

Ms. NOWAK. Not at all. You are correct, Senator. Our ratepayers have already invested over \$11 billion since 2000 to clean up our air. That is continuing to be paid for. We have reduced emissions by 20 percent if you look at 2005 as a baseline. So they have done that. We are not getting credit for it. We are a predominantly coal State. Like Indiana, we are a heavy manufacturing State. This will have a very large impact, our modelers have estimated between \$3 billion and \$13 billion just for generation alone. That doesn't include any natural gas infrastructure or transmission infrastructure that needs to be done.

So that is going to hit every ratepayer from the low income to our large manufacturers.

Senator FISCHER. It will hit every family in Wisconsin and across this Country.

Ms. NOWAK. Right.

Senator FISCHER. Thank you. Thank you, Mr. Chair.

Senator INHOFE. Thank you, Senator Fischer. Senator Sessions, you were the first one here and the last to speak, it looks like.

Senator SESSIONS. Had a little Budget Committee hearing. That makes us all nervous.

Senator SESSIONS. Well, Mr. Easterly, I came here, I remember thinking that I don't like this idea that there needs to be a mix of sources of power. We just should add more nuclear power, that was my simple idea. But as I have been here, and seen the arguments, I am of the belief that if you become too dependent on one source of power, you are not able to have the competition that keeps costs down. Do you believe that is still a valid concern?

Mr. EASTERLY. Yes, Senator. Ironically, we don't have any nuclear, and I would love to have some. But it is so hard to build it, as you know. It is not likely to come in my lifetime.

Senator SESSIONS. Well, that is disappointing, I have to tell you. Natural gas rates have fallen and the costs of plants are up, NRC is more regulatory than ever. We are almost killing it off, which would be a disaster.

I think the unifying issue that we can all agree on, Republicans and Democrats, is a more healthy environment, less particulates, less NO_x, less mercury, less SO_x, things that make people sick and kill trees and that kind of thing. I think we can do better about that. In the course of that, I think it will have a benefit on CO₂ emissions probably at the same time.

But I am going to press down on the brow of my constituents billions and billions of dollars in costs over the CO₂ issue, frankly. We just need to balance this out and be reasonable about it, in my opinion.

So I believe you said, Ms. Nowak, that you believe that if these regulations pass, the cost of electricity will go up. Mr. Parfitt, in your State, do you think it would go up also?

Mr. PARFITT. Yes, that is correct.

Senator SESSIONS. Mr. Easterly.

Mr. EASTERLY. Oh, yes. We just aren't sure how much, but more than double digits.

Senator SESSIONS. And Ms. Nichols, do you believe that if these pass, you indicated, I am not sure what you said, so do you believe it will go up or not?

Ms. NICHOLS. You know, there has been a trend, I would say, over decades, for the cost per unit of electricity to go up. But what we think is important is the bill, what the customer actually sees. And in that event, we are holding steady. We are able to hold that steady.

Senator SESSIONS. Even if these new rules are passed?

Ms. NICHOLS. I believe so, yes.

Senator SESSIONS. Mr. Myers, what is your view about that?

Mr. MYERS. Yes, Senator, I would concur with Ms. Nichols that it has been our experience that you can reduce carbon emissions and also keep electricity prices down.

Senator SESSIONS. Well, Ms. Nowak, you indicated, and we have spent a lot of money, you have spent a lot of money to make coal cleaner than it has ever been before. If those plants are closed, are you saying those are the stranded costs, lost investments that are damaging to the ratepayers in your State?

Ms. NOWAK. Correct. The costs that our modeling estimated it would cost is for new generation only. It doesn't take into account paying for units that have been recently built. Power plants are paid for over many, many years. So ratepayers will be paying for plants that are run much less while at the same time paying for new electricity. So yes.

Senator SESSIONS. Mr. Easterly, I would ask you to see if you can say yes or no on that, too. But let me ask a simple question. It seems to me that mandates, regulations drive up costs, and in an economic sense the same as raising taxes and having the government do it. The government could raise taxes on everybody and then pay for cleaning up power plants or whatever they want to do to achieve a certain goal.

So I just want to translate this into reality for the people who are buying electricity, businesses and homeowners and people like that. So these mandates that require greater expenditures to produce electricity are the equivalent of a tax on their lifestyle. Isn't that correct?

Mr. EASTERLY. Yes, it is. But different people benefit and don't benefit. So if you are in a regulated utility that makes a profit, if the price goes up and your percent of profits is the same, that goes up. If you are an REMC, a co-op, your customers are your owners and they really see it. There is no net benefit there.

Senator SESSIONS. I think that is the question, is the tax on the economy worth the benefit that is achieved. And Dr. Lundborg here, from the Copenhagen Institute, said that the increase in CO₂ over the next 60 years, is not going to be a detriment to the world. In fact, it will be a net benefit. He will agree that if this continues out into the next 150 years, you begin to have a cost.

So he questions all the expenditures we are talking about today. I just believe that is a fundamental thing. He talked about how many lives could be saved for just a fraction of these costs, helping poor people in a lot of different ways.

Thank you, Mr. Chairman. I appreciate this hearing and the good witnesses we have had.

Senator INHOFE. Thank you, Senator Sessions. Senator Boxer wanted to have just a moment for a unanimous consent request to enter something into the record. So we will recognize you for 30 seconds to do that and me for 30 seconds, and then it is over.

Senator BOXER. It is never over.

OK. So, Mr. Chairman, I ask unanimous consent to place into the record a very important chart that shows that Californians are paying \$20 less per month for electricity than the national average as we reduce carbon pollution in such a great way. I am so grateful to Mary Nichols for playing a role in this.

Senator INHOFE. Without objection, so ordered.

[The referenced information follows:]

2013 Average Monthly Bill- Residential

(Data from forms EIA-861- schedules 4A-D, EIA-861S and EIA-861U)

State	Number of Customers	Average Monthly Consumption (kWh)	Average Price (cents/kWh)	Average Monthly Bill (Dollar and cents)
New England	6,221,890	648	16.22	105.09
Connecticut	1,454,963	752	17.55	132.07
Maine	704,775	551	14.35	79.13
Massachusetts	2,708,759	638	15.83	100.97
New Hampshire	603,628	629	16.33	102.66
Rhode Island	438,198	602	15.20	91.48
Vermont	311,567	569	17.14	97.45
Middle Atlantic	15,761,832	706	15.70	110.88
New Jersey	3,461,109	687	15.73	108.10
New York	7,027,866	602	18.79	113.16
Pennsylvania	5,272,857	857	12.79	109.66
East North Central	19,652,153	797	12.14	96.77
Illinois	5,120,607	755	10.63	80.19
Indiana	2,771,260	1,005	10.99	110.44
Michigan	4,265,264	665	14.59	96.95
Ohio	4,875,346	892	12.01	107.07
Wisconsin	2,619,676	703	13.55	95.21
West North Central	9,145,587	969	10.94	106.03
Iowa	1,343,500	909	11.05	100.41
Kansas	1,222,985	926	11.64	107.85
Minnesota	2,329,734	817	11.81	96.51
Missouri	2,708,934	1,086	10.60	115.21
Nebraska	810,867	1,034	10.31	106.65
North Dakota	348,486	1,205	9.12	109.85
South Dakota	381,081	1,055	10.26	108.21
South Atlantic	26,256,056	1,088	11.39	123.93
Delaware	403,519	944	12.95	122.25
District of Columbia	235,322	720	12.57	90.51
Florida	8,756,322	1,078	11.27	121.53
Georgia	4,101,351	1,088	11.46	124.67
Maryland	2,218,948	1,031	13.25	136.63
North Carolina	4,268,019	1,098	10.97	120.52
South Carolina	2,135,432	1,124	11.99	134.86
Virginia	3,273,502	1,156	10.84	125.36
West Virginia	863,641	1,118	9.52	106.44
East South Central	8,093,582	1,210	10.40	125.91
Alabama	2,158,898	1,211	11.26	136.36
Kentucky	1,935,245	1,154	9.79	112.95
Mississippi	1,260,892	1,220	10.78	131.49
Tennessee	2,738,547	1,245	9.98	124.25
West South Central	14,998,178	1,180	10.74	126.75
Arkansas	1,339,680	1,133	9.59	108.64
Louisiana	2,011,044	1,273	9.43	119.98
Oklahoma	1,693,151	1,142	9.67	110.47
Texas	9,954,303	1,174	11.35	133.33
Mountain	9,162,929	876	11.31	99.15
Arizona	2,630,595	1,049	11.71	122.85

2013 Average Monthly Bill- Residential

(Data from forms EIA-861- schedules 4A-D, EIA-861S and EIA-861U)

State	Number of Customers	Average Monthly Consumption (kWh)	Average Price (cents/kWh)	Average Monthly Bill (Dollar and cents)
Colorado	2,169,365	712	11.93	84.91
Idaho	680,930	1,055	9.32	98.35
Montana	477,266	860	10.33	88.85
Nevada	1,094,770	924	11.89	109.94
New Mexico	865,195	655	11.68	76.56
Utah	981,194	798	10.37	82.79
Wyoming	263,614	894	10.16	90.85
Pacific Contiguous	17,890,314	674	13.48	90.84
California	13,359,503	557	16.19	90.19
Oregon	1,650,803	976	9.90	96.58
Washington	2,880,008	1,041	8.70	90.55
Pacific Noncontiguous	699,661	561	28.56	160.32
Alaska	277,275	632	18.12	114.56
Hawaii	422,386	515	36.98	190.36
U.S. Total	127,882,182	909	12.12	110.20

Senator INHOFE. And my 30 seconds, two documents, one from the Census Bureau that says California has the highest U.S. poverty rate when comparing income and cost of living across the State. And second from the Manhattan Institute, the migration from California to Oklahoma increased by 274 percent in the 2000's. And we are adjourned.

Without objection, so ordered.

[The referenced information follows:]

The Supplemental Poverty Measure: 2013

Current Population Reports

By Kathleen Short
Issued October 2014
P60-251

INTRODUCTION

This is the fourth report describing the Supplemental Poverty Measure (SPM) released by the U.S. Census Bureau, with support from the Bureau of Labor Statistics (BLS). The SPM extends the official poverty measure by taking account of many of the government programs designed to assist low-income families and individuals that are not included in the current official poverty measure.

Concerns about the adequacy of the official measure culminated in a congressional appropriation in 1990 for an independent scientific study of the concepts, measurement methods, and information needed for a poverty measure. In response, the National Academy of Sciences (NAS) established the Panel on Poverty and Family Assistance, which released its report, *Measuring Poverty: A New Approach*, in the spring of 1995 (Citro and Michael, 1995). In March of 2010, an Interagency Technical Working Group on Developing a Supplemental Poverty Measure (ITWG) listed suggestions for a new measure that would supplement the current official measure

of poverty.¹ The ITWG was charged with developing a set of initial starting points to permit the Census Bureau, in cooperation with the BLS, to produce the SPM that would be released along with the official measure each year. Their suggestions included:

- The *SPM thresholds* should represent a dollar amount spent on a basic set of goods that includes food, clothing, shelter, and utilities (FCSU), and a small additional amount to allow for other needs (e.g., household supplies, personal care, nonwork-related transportation). This threshold should be calculated with 5 years of expenditure data for family units with exactly two children using Consumer Expenditure Survey data, and it should be adjusted (using a specified equivalence scale) to reflect the needs of different family types and geographic differences in housing costs. Adjustments to thresholds should be made over time to reflect real change in

expenditures on this basic bundle of goods at the 33rd percentile of the expenditure distribution. So far as possible with available data, the calculation of FCSU should include any non-cash benefits that are counted on the resource side for food, shelter, clothing, and utilities. This is necessary for consistency of the threshold and resource definitions.

- The *SPM family unit resources* should be defined as the value of cash income from all sources, plus the value of noncash benefits that are available to buy the basic bundle of goods (FCSU) minus necessary expenses for critical goods and services not included in the thresholds. In-kind benefits include nutritional assistance, subsidized housing, and home energy assistance. Necessary expenses that must be subtracted include income taxes, Social Security payroll taxes, childcare and other work-related expenses, child support payments to another household, and contributions toward the cost of medical care, health insurance premiums, and other medical out-of-pocket costs.

The ITWG stated that the official poverty measure, as defined in

¹ For information, see ITWG, *Observations From the Interagency Technical Working Group on Developing a Supplemental Poverty Measure (Interagency)*, March 2010, available at <www.census.gov/hhes/www/poverty/SPM_TWGObservations.pdf>, accessed September 2014.

Poverty Measure Concepts: Official and Supplemental		
	Official Poverty Measure	Supplemental Poverty Measure
Measurement Units	Families and unrelated individuals	All related individuals who live at the same address, and any coresident unrelated children who are cared for by the family (such as foster children) and any cohabiters and their relatives
Poverty Threshold	Three times the cost of a minimum food diet in 1963	The mean of the 30th to 36th percentile of expenditures on food, clothing, shelter, and utilities (FCSU) of consumer units with exactly two children multiplied by 1.2
Threshold Adjustments	Vary by family size, composition, and age of householder	Geographic adjustments for differences in housing costs by tenure and a three-parameter equivalence scale for family size and composition
Updating Thresholds	Consumer Price Index: all items	Five-year moving average of expenditures on FCSU
Resource Measure	Gross before-tax cash income	Sum of cash income, plus noncash benefits that families can use to meet their FCSU needs, minus taxes (or plus tax credits), minus work expenses, minus out-of-pocket medical expenses and child support paid to another household

Office of Management and Budget (OMB) Statistical Policy Directive No. 14, will not be replaced by the SPM. They noted that the official measure is sometimes identified in legislation regarding program eligibility and funding distribution, while the SPM will not be used in this way. The SPM is designed to provide information on aggregate levels of economic need at a national level or within large subpopulations or areas and, as such, the SPM will be an additional macroeconomic statistic providing further understanding of economic conditions and trends.

This report presents updated estimates of the prevalence of poverty in the United States, overall and for selected demographic groups, using the official measure and the SPM. Section one presents differences between the official poverty measure and the SPM. Comparing the two measures sheds light on the effects of noncash benefits, taxes, and other nondiscretionary expenses on measured economic well-being. The distribution of income-to-poverty threshold ratios and poverty rates by state are

estimated and compared for the two measures. The second section of the report examines the SPM itself. Effects of benefits and expenses on SPM rates are explicitly examined, and SPM estimates for 2013 are compared with the 2012 figures to assess changes in SPM rates from the previous year. SPM rates for the 5 years for which there are comparable estimates, 2009 to 2013, are also shown.

POVERTY ESTIMATES FOR 2013: OFFICIAL AND SPM

The measures presented in this study use the 2014 Current Population Survey Annual Social and Economic Supplement (CPS ASEC) income information that refers to calendar year 2013 to estimate SPM

resources.² These are the same data used for the preparation of official

² The data in this report are from the 2010 to 2014 Current Population Survey Annual Social and Economic Supplement (CPS ASEC). The estimates in this paper (which may be shown in text, figures, and tables) are based on responses from a sample of the population and may differ from actual values because of sampling variability or other factors. As a result, apparent differences between the estimates for two or more groups may not be statistically significant. All comparative statements have undergone statistical testing and are significant at the 90 percent confidence level unless otherwise noted. Standard errors were calculated using replicate weights. Further information about the source and accuracy of the estimates is available at <www.census.gov/hhes/www/p60-243sa.pdf>, <www.census.gov/hhes/www/p60-245sa.pdf>, and <ftp2.census.gov/library/publications/2014/demo/p60-249sa.pdf>, accessed September 2014. The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the improved set of health insurance coverage items. The redesigned income questions were implemented using a split panel design. Approximately 68,000 addresses were selected to receive a set of income questions similar to those used in the 2013 CPS ASEC. The remaining 30,000 addresses were selected to receive the redesigned income questions. The source of data for this report is the portion of the CPS ASEC sample which received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses. Estimates published in this report and the corresponding income and poverty detailed tables available on the Internet may vary from estimates based on the full sample.

Table 1.
Two Adult, Two Child Poverty Thresholds: 2012 and 2013
(In dollars)

Measure	2012	Standard error	2013	Standard error
Official Poverty Measure	23,283	X	23,624	X
Supplemental Poverty Measure				
Owners with a mortgage	25,784	368	25,639	289
Owners without a mortgage	21,400	233	21,397	337
Renters	25,105	398	25,144	400

X Not applicable.

Source: Bureau of Labor Statistics, September 2014 <www.bls.gov/pir/spmhome.htm>.

Resource Estimates	
SPM Resources = Money Income From All Sources	
Plus:	Minus:
Supplemental Nutritional Assistance (SNAP)	Taxes (plus credits such as the Earned Income Tax Credit (EITC))
National School Lunch Program	Expenses Related to Work
Supplementary Nutrition Program for Women Infants and Children (WIC)	Child Care Expenses
Housing subsidies	Medical Out-of-Pocket Expenses (MOOP)
Low-Income Home Energy Assistance (LIHEAP)	Child Support Paid

poverty statistics and reported in DeNavas-Walt and Proctor (2014).³

The SPM thresholds for 2013 are based on out-of-pocket spending on basic needs (FCSU).⁴ Thresholds use 5 years of quarterly data from the Consumer Expenditure Survey (CE); the thresholds are produced at the BLS.^{5,6}

³ The official thresholds are used for the official poverty estimates presented here, however, unlike the official estimates, unrelated individuals under the age of 15 are included in the universe. Since the CPS ASEC does not ask income questions for individuals under age 15, they are excluded from the universe for official poverty calculations. For the official poverty estimates shown in this report, all unrelated individuals under age 15 are included and presumed to be in poverty. For the SPM, they are assumed to share resources with the household reference person.

⁴ See appendix for description of threshold calculation.

⁵ Bureau of Labor Statistics, Experimental Poverty Measure Web site, <www.bls.gov/pir/spmhome.htm>, accessed September 2014.

⁶ See <www.bls.gov/cex/anthology08/csxanth2.pdf> or <www.bls.gov/cex/anthology08/csxanth3.pdf> for information on the CE, accessed September 2014.

Expenditures on shelter and utilities are determined for three housing tenure groups. The three groups include owners with mortgages, owners without mortgages, and renters. The thresholds used here include the value of Supplemental Nutrition Assistance Program (SNAP) benefits in the measure of spending on food.⁷

Thresholds for 2012 and 2013 are in Table 1. The American Community Survey (ACS) data on rents paid are used to adjust the SPM thresholds for differences in spending on housing across geographic areas.⁸

The two measures use different units of analysis. The official measure of poverty uses the census-defined family that includes all

⁷ For consistency in measurement with the resource measure, the thresholds should include the value of noncash benefits, though additional research continues at BLS on appropriate methods.

⁸ See appendix for description of the geographic adjustments.

individuals residing together who are related by birth, marriage, or adoption and treats all unrelated individuals over age 15 independently. For the SPM, the "family unit" includes all related individuals who live at the same address, as well as any coresident unrelated children who are cared for by the family (such as foster children), and any cohabiters and their children.⁹ These units are referred to as SPM Resource Units. Selection of the unit of analysis for poverty measurement implies that members of that unit share income or resources with one another.

SPM thresholds are adjusted for the size and composition of the SPM Resource Unit relative to the two-adult-two-child threshold using

⁹ This definition corresponds broadly with the unit of data collection (the consumer unit) that is employed for the CE data used to calculate poverty thresholds.

an equivalence scale.¹⁰ The official measure adjusts thresholds based on family size, number of children and adults, as well as whether or not the householder is aged 65 or over. The official poverty threshold for a two-adult-two-child family was \$23,624 in 2013. The SPM thresholds vary by housing tenure and are higher for owners with mortgages and renters than the official threshold. These two groups comprise about 76 percent of the total population. The official threshold increased by \$341 between 2012 and 2013. None of the SPM thresholds changed significantly between 2012 and 2013.

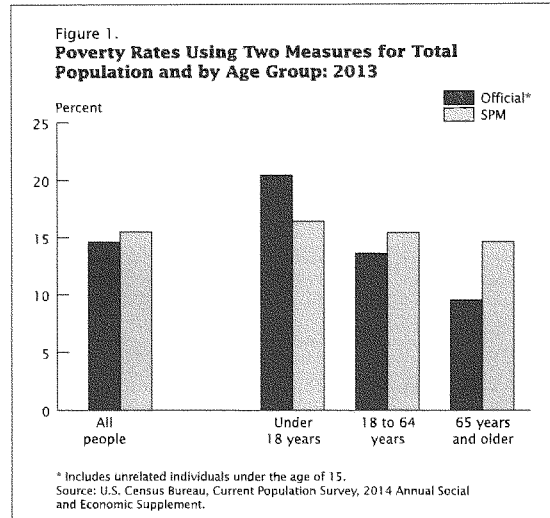
SPM resources are estimated as the sum of cash income plus any federal government noncash benefits that families can use to meet their FCSU needs and minus taxes (plus tax credits), work expenses, and out-of-pocket medical expenses. The text box summarizes the additions and subtractions for the SPM; descriptions are in the appendix.

POVERTY RATES: OFFICIAL AND SPM

Figure 1 shows poverty rates using the two measures for the total population and for three age groups: under 18 years, 18 to 64 years, and 65 years and over. Table 2 shows rates for a variety of selected demographic groups. The percent of the population that was poor using the official measure for 2013 was 14.5 percent (DeNavas-Walt and Proctor, 2014). For this study, including unrelated individuals under age 15 in the universe, the official poverty rate was 14.6 percent.¹¹ The SPM yields a rate

¹⁰ See appendix for description of the three-parameter scale.

¹¹ The 14.5 and 14.6 rates are not statistically different.



of 15.5 percent for 2013. While, as noted, SPM poverty thresholds are generally higher than official thresholds, other parts of the measure also contribute to differences in the estimated prevalence of poverty in the United States.

In 2013, 48.7 million were poor using the SPM definition of poverty, more than the 45.8 million using the official definition of poverty with our universe. For most groups, SPM rates were higher than the official poverty rates. Compared with the official measure, the SPM shows lower poverty rates for children, individuals included in new SPM Resource Units, Blacks, renters, those living outside metropolitan areas, those covered by only public health insurance, and individuals with a work disability. Most other groups had higher poverty rates using the SPM, rather than the

official measure. Official and SPM poverty rates for females, people in female householder units, native-born citizens, residents of the South or the Midwest, and those not working at least 1 week were not statistically different. Note that poverty rates for those 65 years and over were higher under the SPM compared with the official measure. This partially reflects that the official thresholds are set lower for families with householders in this age group, while the SPM thresholds do not vary by age.¹²

Distribution of Income-to-Poverty Threshold Ratios: Official and SPM

Comparing the distribution of gross cash income with that of SPM

¹² For more information about the SPM and the aged population, see Bridges and Gesumaria (2014).

Table 2.

Number and Percentage of People in Poverty by Different Poverty Measures: 2013

(Data are based on the CPS ASEC sample of 68,000 addresses.¹ Numbers in thousands, confidence intervals [C.I.] in thousands or percentage points as appropriate. People as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see [ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf](http://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf))

Characteristic	Number** (in thousands)	Official**				SPM				Difference	
		Number		Percent		Number		Percent		Number	Percent
		Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)		
All people.	313,395	45,748	1,013	14.6	0.3	48,671	1,051	15.5	0.3	*2,923	*0.9
Sex											
Male.	153,596	20,355	571	13.3	0.4	22,839	593	14.9	0.4	*2,484	*1.6
Female.	159,799	25,393	571	15.9	0.4	25,832	581	16.2	0.4	439	0.3
Age											
Under 18 years	74,055	15,089	453	20.4	0.6	12,177	388	16.4	0.5	*-2,912	*-3.9
18 to 64 years	194,833	26,429	648	13.6	0.3	29,987	700	15.4	0.4	*3,558	*1.8
65 years and older.	44,508	4,231	227	9.5	0.5	6,507	271	14.6	0.6	*2,276	*5.1
Type of Unit											
Married couple.	188,571	12,630	627	6.7	0.3	17,855	709	9.5	0.4	*5,226	*2.8
Female householder.	62,924	17,998	630	28.6	0.9	17,959	652	28.5	0.9	-39	-0.1
Male householder.	33,947	6,357	334	18.7	0.9	7,853	394	23.1	1.1	*1,496	*4.4
New SPM unit.	27,953	8,764	427	31.4	1.3	5,004	379	17.9	1.3	*-3,760	*-13.5
Race² and Hispanic Origin											
White	243,399	30,250	815	12.4	0.3	33,445	818	13.7	0.3	*3,195	*1.3
White, not Hispanic	195,399	19,027	723	9.7	0.4	20,946	668	10.7	0.3	*1,919	*1.0
Black	40,671	11,097	507	27.3	1.3	10,056	498	24.7	1.2	*-1,041	*-2.6
Asian	17,070	1,792	176	10.5	1.0	2,800	260	16.4	1.5	*1,008	*5.9
Hispanic (any race)	54,253	12,853	512	23.7	0.9	14,085	556	26.0	1.0	*1,232	*2.3
Nativity											
Native born	272,387	38,339	945	14.1	0.3	38,928	949	14.3	0.3	589	0.2
Foreign born	41,009	7,409	372	18.1	0.8	9,743	427	23.8	0.9	*2,334	*5.7
Naturalized citizen	19,150	2,428	172	12.7	0.9	3,356	204	17.5	1.0	*928	*4.8
Not a citizen.	21,859	4,981	311	22.8	1.2	6,387	366	29.2	1.3	*1,406	*6.4
Tenure											
Owner	208,717	16,127	734	7.7	0.3	20,504	761	9.8	0.4	*4,377	*2.1
Owner/mortgage	136,059	7,739	479	5.7	0.4	11,267	569	8.3	0.4	*3,528	*2.6
Owner/no mortgage/rent free.	75,999	9,254	486	12.2	0.5	9,970	524	13.1	0.6	*716	*0.9
Renter	101,338	28,755	876	28.4	0.7	27,434	855	27.1	0.7	*-1,321	*-1.3
Residence											
Inside metropolitan statistical areas.	266,259	38,089	1,006	14.3	0.3	42,452	1,052	15.9	0.4	*4,362	*1.6
Inside principal cities.	102,295	19,676	845	19.2	0.7	20,516	760	20.1	0.6	*840	*0.8
Outside principal cities.	163,963	18,413	746	11.2	0.4	21,936	819	13.4	0.4	*3,523	*2.1
Outside metropolitan statistical areas ³	47,137	7,659	675	16.2	1.0	6,220	586	13.2	0.9	*-1,439	*-3.1
Region											
Northeast.	55,566	7,134	442	12.8	0.8	7,947	490	14.3	0.9	*813	*1.5
Midwest.	66,872	8,677	432	13.0	0.7	8,351	416	12.5	0.6	-326	-0.5
South.	117,109	19,018	708	16.2	0.6	18,565	705	15.9	0.6	-454	-0.4
West.	73,849	10,919	433	14.8	0.6	13,809	495	18.7	0.7	*2,890	*3.9
Health Insurance Coverage											
With private insurance.	201,064	10,440	461	5.2	0.2	16,439	604	8.2	0.3	*5,999	*3.0
With public, no private insurance.	70,378	23,996	776	34.1	0.9	20,032	681	28.5	0.8	*-3,964	*-5.6
Not insured	41,953	11,313	431	27.0	0.9	12,201	468	29.1	1.0	*888	*2.1

See footnotes at end of table.

Table 2.

Number and Percentage of People in Poverty by Different Poverty Measures: 2013—Con.

(Data are based on the CPS ASEC sample of 68,000 addresses.¹ Numbers in thousands, confidence intervals [C.I.] in thousands or percentage points as appropriate. People as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see [ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf](http://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf))

Characteristic	Number** (in thousands)	Official**				SPM				Difference	
		Number		Percent		Number		Percent			
		Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Number	Percent
Work Experience											
Total, 18 to 64 years	194,833	26,429	648	13.6	0.3	29,987	700	15.4	0.4	*3,558	*1.8
All workers	146,252	10,736	347	7.3	0.2	14,357	447	9.8	0.3	*3,621	*2.5
Worked full-time, year-round	100,855	2,771	155	2.7	0.2	5,479	214	5.4	0.2	*2,708	*2.7
Less than full-time, year-round	45,397	7,965	322	17.5	0.6	8,878	353	19.6	0.7	*913	*2.0
Did not work at least 1 week	48,581	15,693	515	32.3	0.9	15,630	504	32.2	0.8	-63	-0.1
Disability Status⁴											
Total, 18 to 64 years	194,833	26,429	648	13.6	0.3	29,987	700	15.4	0.4	*3,558	*1.8
With a disability	15,098	4,352	233	28.8	1.2	4,126	235	27.3	1.2	*-226	*-1.5
With no disability	178,761	22,023	567	12.3	0.3	25,799	649	14.4	0.4	*3,776	*2.1

¹ An asterisk preceding an estimate indicates change is statistically different from zero at the 90 percent confidence level.

** Includes unrelated individuals under the age of 15.

¹ A 90 percent confidence interval is a measure of an estimate's variability. The larger the confidence interval in relation to the size of the estimate, the less reliable the estimate. Confidence intervals shown in this table are based on standard errors calculated using replicate weights. For more information see "Standard Errors and Their Use" at <<http://ftp2.census.gov/library/publications/2014/demo/p60-249sa.pdf>>.

² The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the redesigned set of health insurance coverage questions. The redesigned income questions were implemented to a subsample of these 98,000 addresses using a probability split panel design. Approximately 68,000 addresses were eligible to receive a set of income questions similar to those used in the 2013 CPS ASEC and the remaining 30,000 addresses were eligible to receive the redesigned income questions. The source of the 2013 data for this table is the portion of the CPS ASEC sample which received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses.

³ Federal surveys give respondents the option of reporting more than one race. Therefore, two basic ways of defining a race group are possible. A group such as Asian may be defined as those who reported Asian and no other race (the race-alone or single-race concept) or as those who reported Asian regardless of whether they also reported another race (the race-alone-or-in-combination concept). This table shows data using the first approach (race alone). The use of the single-race population does not imply that it is the preferred method of presenting or analyzing data. The Census Bureau uses a variety of approaches. Information on people who reported more than one race, such as White and American Indian and Alaska Native or Asian and Black or African American, is available from Census 2010 through American FactFinder. About 2.9 percent of people reported more than one race in Census 2010. Data for American Indians and Alaska Natives, Native Hawaiians and Other Pacific Islanders, and those reporting two or more races are not shown separately.

⁴ The "Outside metropolitan statistical areas" category includes both micropolitan statistical areas and territory outside of metropolitan and micropolitan statistical areas. For more information, see "About Metropolitan and Micropolitan Statistical Areas" at <www.census.gov/population/metro>.

⁵ The sum of those with and without a disability does not equal the total because disability status is not defined for individuals in the Armed Forces.

Source: U.S. Census Bureau, Current Population Survey, 2014 Annual Social and Economic Supplement.

resources also allows an examination of the effect of taxes and non-cash transfers on SPM rates. Table 3 shows the distribution of income-to-poverty threshold ratios for various groups. Dividing income by the respective poverty threshold controls income by unit size and composition. Figure 2 shows the percent distribution of income-to-threshold ratio categories for all people.

In general, the comparison suggests that a smaller percentage of the population was in the lowest category of the distribution using

the SPM. For most groups, including targeted noncash benefits reduced the percentage of the population in the lowest category—those with income below half their poverty threshold. This was true for the age groups shown in Table 3, except for those over age 64. They showed a higher percentage below half of the poverty line with the SPM: 4.8 percent compared to 2.7 percent with the official measure. As shown earlier, many of the non-cash benefits included in the SPM are not targeted to this population. Further, many transfers received by

this group are in cash, especially Social Security payments, and are captured in the official measure, as well as the SPM. Note that the percentage of the 65 years and over age group with cash income below half their threshold was lower than that of other age groups under the official measure (2.7 percent), while the percentage for children was higher (9.3 percent). Subtracting MOOP and other expenses and adding noncash benefits in the SPM narrowed the differences across the three age groups.

Table 3.

Percentage of People by Ratio of Income/Resources to Poverty Threshold: 2013

(Data are based on the CPS ASEC sample of 68,000 addresses.¹ Numbers in thousands, confidence intervals [C.I.] in thousands or percentage points as appropriate. People as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see [ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf](http://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf))

Characteristic	Less than 0.5	90 percent C.I. ² (±)	0.5 to 0.99	90 percent C.I. ² (±)	1.0 to 1.49	90 percent C.I. ² (±)	1.5 to 1.99	90 percent C.I. ² (±)	2.0 to 3.99	90 percent C.I. ² (±)	4.0 or more	90 percent C.I. ² (±)
OFFICIAL*												
All people.	6.5	0.2	8.1	0.3	9.8	0.2	9.6	0.3	30.0	0.4	36.1	0.5
Age												
Under 18 years	9.3	0.4	11.0	0.6	12.1	0.5	10.4	0.4	29.1	0.7	28.0	0.6
18 to 64 years	6.2	0.2	7.3	0.2	8.5	0.2	8.6	0.3	29.6	0.4	39.7	0.5
65 years and older.	2.7	0.3	6.8	0.4	11.5	0.5	12.1	0.6	33.0	0.9	33.8	1.0
Race³ and Hispanic Origin												
White	5.4	0.2	7.0	0.3	9.1	0.3	9.5	0.3	30.5	0.5	38.4	0.5
White, not Hispanic	4.4	0.2	5.3	0.2	7.4	0.3	8.5	0.3	30.8	0.6	43.5	0.6
Black	12.3	0.8	14.9	1.0	13.5	0.9	10.0	0.7	27.1	1.1	22.1	1.1
Asian	5.2	0.7	5.3	0.8	8.7	1.2	8.9	1.1	29.6	1.9	42.3	2.0
Hispanic (any race)	9.6	0.6	14.1	0.8	15.8	0.8	13.6	0.7	29.1	1.0	17.8	0.8
SPM												
All people.	5.2	0.2	10.3	0.3	17.0	0.3	14.4	0.3	34.7	0.4	18.4	0.4
Age												
Under 18 years	4.4	0.3	12.0	0.5	21.5	0.6	16.7	0.5	33.2	0.6	12.2	0.4
18 to 64 years	5.6	0.2	9.8	0.3	15.2	0.4	13.8	0.3	35.5	0.4	20.2	0.5
65 years and older.	4.8	0.4	9.8	0.5	17.2	0.7	13.3	0.6	33.9	0.9	20.9	0.8
Race³ and Hispanic Origin												
White	4.7	0.2	9.0	0.3	15.5	0.3	14.0	0.4	36.2	0.5	20.5	0.4
White, not Hispanic	4.1	0.2	6.6	0.3	12.6	0.4	13.4	0.4	39.3	0.5	24.0	0.5
Black	7.7	0.7	17.0	1.0	24.2	1.1	16.1	0.9	26.6	1.2	8.5	0.6
Asian	6.0	0.8	10.4	1.3	16.9	1.5	14.4	1.4	35.1	1.9	17.1	1.4
Hispanic (any race)	7.0	0.5	18.9	0.9	27.5	0.9	16.3	0.8	24.0	1.0	6.2	0.4

* Includes unrelated individuals under the age of 15.

¹ A 90 percent confidence interval is a measure of an estimate's variability. The larger the confidence interval in relation to the size of the estimate, the less reliable the estimate. Confidence intervals shown in this table are based on standard errors calculated using replicate weights. For more information see "Standard Errors and Their Use" at <[ftp://ftp2.census.gov/library/publications/2014/demo/p60-249sa.pdf](http://ftp2.census.gov/library/publications/2014/demo/p60-249sa.pdf)>.

² The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the redesigned set of health insurance coverage questions. The redesigned income questions were implemented to a subsample of these 98,000 addresses using a probability split panel design. Approximately 68,000 addresses were eligible to receive a set of income questions similar to those used in the 2013 CPS ASEC and the remaining 30,000 addresses were eligible to receive the redesigned income questions. The source of the 2013 data for this table is the portion of the CPS ASEC sample which received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses.

³ Federal surveys give respondents the option of reporting more than one race. Therefore, two basic ways of defining a race group are possible. A group such as Asian may be defined as those who reported Asian and no other race (the race-alone or single-race concept) or as those who reported Asian regardless of whether they also reported another race (the race-alone-or-in-combination concept). This table shows data using the first approach (race alone). The use of the single-race population does not imply that it is the preferred method of presenting or analyzing data. The Census Bureau uses a variety of approaches. Information on people who reported more than one race, such as White and American Indian and Alaska Native or Asian and Black or African American, is available from Census 2010 through American FactFinder. About 2.9 percent of people reported more than one race in Census 2010. Data for American Indians and Alaska Natives, Native Hawaiians and Other Pacific Islanders, and those reporting two or more races are not shown separately.

Source: U.S. Census Bureau, Current Population Survey, 2014 Annual Social and Economic Supplement.

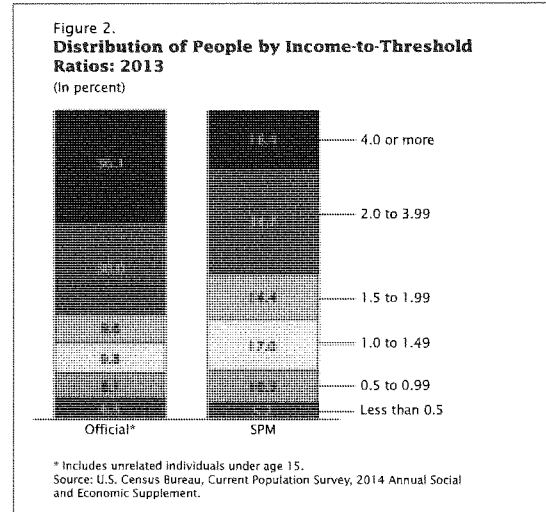
Table 3 shows similar calculations by race and ethnicity. Using the SPM, smaller percentages had income below half of their poverty thresholds, compared with the official measure, for all groups shown except for Asians. For Blacks, the percentage in this lowest category was 12.3 percent with the official measure and 7.7 percent with the SPM. The percentage of Whites and Hispanics in the lowest category was also lower using the SPM.

On the other hand, the SPM shows a smaller percentage with income or resources in the highest category—4 or more times the thresholds. The SPM resource measure subtracts taxes—compared with the official measure, which does not—bringing down the percentage of people with income in the highest category.

Another notable difference between the distributions using these two measures was the larger number of individuals with income-to-threshold ratios in the three middle categories with the SPM. Since the effect of taxes and transfers is often to move family income from the extremes of the distribution to the center of the distribution, that is, from the very bottom with targeted transfers or from the very top via taxes and other expenses, the increase in the size of these middle categories is to be expected.

Poverty Rates by State: Official and SPM

The Census Bureau recommends using the American Community Survey (ACS) for state-level poverty estimates, however, it is difficult to calculate the SPM with data from that survey. (Future research will explore use of the ACS for this purpose.) With CPS data, the Census Bureau recommends the



use of 3-year averages to compare estimates across states. Table 4 shows 3-year averages of poverty rates for the two measures for the U.S. total and for each state. The 3-year average poverty rates for the United States for the years 2011, 2012, and 2013 were 14.9 percent with the official measure and 15.9 percent using the SPM.

Figure 3 shows the United States divided into three categories by state: states where the rates are higher or lower using the SPM compared with using the official measure and states where the rates are not statistically different. The 13 states for which the SPM rates were higher than the official poverty rates are those with lighter shades. These states were Alaska, California, Connecticut, Florida, Hawaii, Illinois, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New York, and Virginia. The SPM rate for the District of

Columbia was also higher. Higher SPM rates by state may occur from many sources. Geographic adjustments for housing costs may result in higher SPM thresholds, as well as a different mix of housing tenure or metropolitan area status, or higher nondiscretionary expenses, such as taxes or medical expenses.

Medium shades represent the 26 states where SPM rates were lower than the official poverty rates. These states were Alabama, Arkansas, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Michigan, Mississippi, Missouri, Montana, Nebraska, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, West Virginia, Wisconsin, and Wyoming. Lower SPM rates would occur due to lower thresholds reflecting lower housing costs, a different mix of housing tenure or metropolitan area status, or more generous

Table 4.
Number and Percentage of People in Poverty by State Using 3-Year Average Over 2011, 2012, and 2013

(Data for 2013 are based on the CPS ASEC sample of 68,000 addresses.¹ Numbers in thousands, confidence intervals [C.I.] in thousands or percentage points as appropriate. People as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see [ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf](http://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf))

State	Official** 3-year average 2011 to 2013				SPM 3-year average 2011 to 2013				Difference	
	Number	90 per- cent C.I. ¹ (±)	Percent	90 per- cent C.I. ¹ (±)	Number	90 per- cent C.I. ¹ (±)	Percent	90 per- cent C.I. ¹ (±)	Number	Percent
United States.....	46,444	584	14.9	0.2	49,323	614	15.9	0.2	*2,879	*0.9
Alabama.....	772	60	16.2	1.2	672	69	14.1	1.4	*-100	*-2.1
Alaska.....	79	10	11.2	1.5	90	10	12.7	1.3	*11	*1.6
Arizona.....	1,253	123	18.9	1.9	1,259	118	19.0	1.8	6	0.1
Arkansas.....	547	65	18.7	2.3	470	55	16.1	1.9	*-77	*-2.6
California.....	6,072	207	16.0	0.5	8,871	266	23.4	0.7	*2,798	*7.4
Colorado.....	620	63	12.0	1.2	660	57	12.8	1.1	41	0.8
Connecticut.....	376	35	10.7	1.0	441	35	12.5	1.0	*65	*1.9
Delaware.....	125	11	13.8	1.2	126	11	13.9	1.2	1	0.1
District of Columbia.....	127	10	19.9	1.5	142	11	22.4	1.7	*15	*2.4
Florida.....	2,896	150	15.1	0.8	3,675	152	19.1	0.8	*779	*4.1
Georgia.....	1,712	121	17.6	1.2	1,695	131	17.5	1.3	-17	-0.2
Hawaii.....	169	19	12.4	1.4	249	22	18.4	1.6	*81	*5.9
Idaho.....	228	32	14.4	2.0	176	29	11.1	1.9	*-52	*-3.3
Illinois.....	1,717	118	13.5	0.9	1,905	113	14.9	0.9	*188	*1.5
Indiana.....	905	85	14.2	1.3	841	85	13.2	1.3	*-64	*-1.0
Iowa.....	323	27	10.6	0.9	264	21	8.7	0.7	*-60	*-2.0
Kansas.....	399	35	14.1	1.3	334	32	11.8	1.2	*-64	*-2.3
Kentucky.....	789	71	18.1	1.6	599	61	13.8	1.4	*-190	*-4.4
Louisiana.....	926	122	20.6	2.7	822	89	18.3	1.9	*-104	*-2.3
Maine.....	172	16	13.0	1.2	142	14	10.7	1.1	*-30	*-2.3
Maryland.....	586	45	9.9	0.8	792	67	13.4	1.1	*206	*3.5
Massachusetts.....	753	69	11.5	1.0	906	73	13.8	1.1	*152	*2.3
Michigan.....	1,413	113	14.5	1.2	1,305	103	13.4	1.1	*-109	*-1.1
Minnesota.....	577	52	10.8	1.0	562	49	10.5	0.9	-14	-0.3
Mississippi.....	603	57	20.7	2.0	446	36	15.3	1.3	*-157	*-5.4
Missouri.....	887	114	14.9	1.9	733	101	12.3	1.7	*-154	*-2.6
Montana.....	149	19	15.0	2.0	117	15	11.7	1.5	*-33	*-3.3
Nebraska.....	209	28	11.3	1.5	189	21	10.3	1.1	*-20	*-1.1
Nevada.....	445	39	16.3	1.4	545	43	20.0	1.6	*100	*3.7
New Hampshire.....	109	11	8.3	0.9	138	14	10.5	1.0	*28	*2.2
New Jersey.....	936	91	10.7	1.0	1,394	111	15.9	1.3	*458	*5.2
New Mexico.....	444	44	21.5	2.1	331	33	16.0	1.6	*-113	*-5.4
New York.....	3,104	134	16.0	0.7	3,403	154	17.5	0.8	*299	*1.5
North Carolina.....	1,649	164	17.2	1.7	1,484	123	15.4	1.3	*-165	*-1.7
North Dakota.....	73	10	10.5	1.4	64	6	9.2	0.9	*-9	*-1.3
Ohio.....	1,688	148	14.8	1.3	1,438	111	12.6	1.0	*-250	*-2.2
Oklahoma.....	580	56	15.5	1.5	462	43	12.4	1.2	*-118	*-3.2
Oregon.....	563	56	14.5	1.4	564	59	14.5	1.5	1	Z
Pennsylvania.....	1,668	133	13.1	1.1	1,621	122	12.7	1.0	-47	-0.4
Rhode Island.....	141	12	13.6	1.2	145	13	14.0	1.2	4	0.4
South Carolina.....	804	68	17.3	1.4	763	65	16.4	1.4	*-42	*-0.9
South Dakota.....	106	18	12.8	2.3	80	14	9.7	1.7	*-26	*-3.1

See footnotes at end of table.

Table 4.
Number and Percentage of People in Poverty by State Using 3-Year Average Over 2011, 2012, and 2013—Con.

(Data for 2013 are based on the CPS ASEC sample of 68,000 addresses.¹ Numbers in thousands, confidence intervals [C.I.] in thousands or percentage points as appropriate. People as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see [ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf](http://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf))

State	Official** 3-year average 2011 to 2013				SPM 3-year average 2011 to 2013				Difference	
	Number	90 per- cent C.I. [†] (±)	Percent	90 per- cent C.I. [†] (±)	Number	90 per- cent C.I. [†] (±)	Percent	90 per- cent C.I. [†] (±)	Number	Percent
Tennessee	1,139	126	17.8	2.0	1,003	102	15.6	1.6	*-136	*-2.1
Texas	4,484	233	17.2	0.9	4,143	218	15.9	0.8	*-341	*-1.3
Utah	289	39	10.2	1.4	315	50	11.1	1.8	25	0.9
Vermont	66	6	10.6	1.0	60	6	9.7	1.0	-6	-0.9
Virginia	880	81	10.9	1.0	1,092	108	13.6	1.3	*211	*2.6
Washington	833	76	12.2	1.1	866	63	12.6	0.9	33	0.5
West Virginia	317	52	17.4	2.7	240	36	13.2	1.9	*-77	*-4.2
Wisconsin	680	64	12.0	1.1	635	60	11.2	1.1	*-45	*-0.8
Wyoming	63	7	10.9	1.3	55	6	9.7	1.1	*-7	*-1.3

Z Represents or rounds to zero.

* An asterisk preceding an estimate indicates change is statistically different from zero at the 90 percent confidence level.

** Includes unrelated individuals under the age of 15.

[†] A 90 percent confidence interval is a measure of an estimate's variability. The larger the confidence interval in relation to the size of the estimate, the less reliable the estimate. Confidence intervals shown in this table are based on standard errors calculated using replicate weights. For more information see "Standard Errors and Their Use" at <<http://ftp2.census.gov/library/publications/2014/demo/p80-249sa.pdf>>.

¹ The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the redesigned set of health insurance coverage questions. The redesigned income questions were implemented to a subsample of these 98,000 addresses using a probability split panel design. Approximately 68,000 addresses were eligible to receive a set of income questions similar to those used in the 2013 CPS ASEC and the remaining 30,000 addresses were eligible to receive the redesigned income questions. The source of the 2013 data for this table is the portion of the CPS ASEC sample which received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses.

Source: U.S. Census Bureau, Current Population Survey, 2012 to 2014 Annual Social and Economic Supplements.

noncash benefits. Darker shades are those 11 states that were not statistically different under the two measures and include Arizona, Colorado, Delaware, Georgia, Minnesota, Oregon, Pennsylvania, Rhode Island, Utah, Vermont, and Washington. Details are in Table 4.

THE SUPPLEMENTAL POVERTY MEASURE

The Effect of Cash and Noncash Transfers, Taxes, and Other Nondiscretionary Expenses

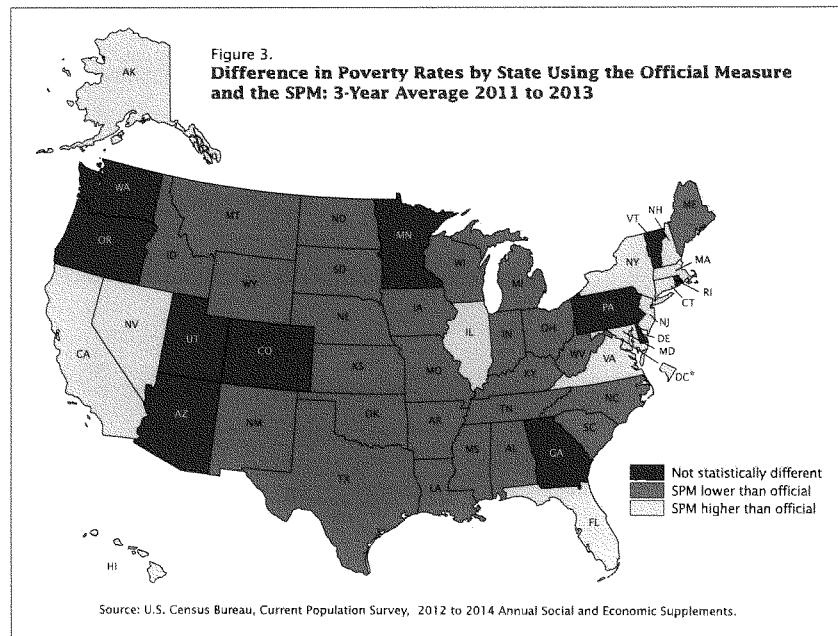
The purpose of this section is to move away from comparing the SPM with the official measure and look only at the SPM. This exercise allows us to gauge the effects of taxes and transfers and other

necessary expenses using the SPM as the measure of economic well-being. The previous section characterized the poverty population using the SPM in comparison with the current official measure. This section examines in more detail the population defined as poor when using the SPM.

The official poverty measure takes account of cash benefits from the government, such as Social Security and Unemployment Insurance (UI) benefits, Supplemental Security Income (SSI), public assistance benefits, such as TANF, and workers' compensation benefits, but does not take account of taxes or noncash benefits aimed at improving the economic situation of the poor. Besides taking account

of cash benefits and necessary expenses, such as MOOP expenses and expenses related to work, the SPM includes taxes and noncash transfers. The important contribution that the SPM provides is allowing us to gauge the effectiveness of tax credits and transfers in alleviating poverty. We can also examine the effects of the nondiscretionary expenses such as work and MOOP expenses.

Table 5a shows the effect that various additions and subtractions had on the SPM rate in 2013, holding all else the same and assuming no behavioral changes. Additions and subtractions are shown for the total population and by three age groups. Additions shown in the table include cash benefits, also



accounted for in the official measure, as well as noncash benefits, included only in the SPM. This allows us to examine the effects of government transfers on poverty estimates. Because child support paid is subtracted from income, we also examine the effect of child support received on alleviating poverty. Child support payments received are counted as income in both the official measure and the SPM.

Removing one item from the calculation of family resources and recalculating poverty rates shows, for example, that without Social Security benefits, the SPM rate would have been 24.1 percent, rather than 15.5 percent. Not including refundable tax credits

(the EITC and the refundable portion of the child tax credit) in resources, the poverty rate for all people would have been 18.4 percent, rather than 15.5 percent, all else constant. On the other hand, removing amounts paid for child support, income and payroll taxes, work-related expenses, and MOOP expenses from the calculation resulted in lower poverty rates. Without subtracting MOOP expenses from income, the SPM rate would have been 12.0 percent, rather than 15.5 percent. Table 5b shows the same calculations for the year 2012.

In 2013, not accounting for refundable tax credits would have resulted in a poverty rate of 22.8 percent for children, rather than

16.4 percent. Not subtracting MOOP expenses from the income of families with children would have resulted in a poverty rate of 13.3 percent. For the 65 years and over group, however, WIC and payments for child support had no statistically significant effect, while SPM rates increased by about 6.3 percentage points with the subtraction of MOOP expenses from income. Clearly, the subtraction of MOOP expenses had an important effect on SPM rates for this group. On the other hand, Social Security benefits lowered poverty rates by 38.0 percentage points for the 65 and over group.

Figure 4 shows the percentage point difference in the SPM rate when each item is included in the

Table 5a.

Effect of Individual Elements on SPM Rates: 2013

(Data are based the CPS ASEC sample of 68,000 addresses.¹ Confidence intervals [C.I.] in percentage points. Percent of people as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see [ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf](http://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf))

Elements	All people		Under 18 years		18 to 64 years		65 years and over	
	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)
SPM	15.5	0.3	16.4	0.5	15.4	0.4	14.6	0.6
ADDITIONS								
Social Security	24.1	0.4	18.6	0.6	19.8	0.4	52.6	1.0
Refundable tax credits	18.4	0.4	22.8	0.6	17.5	0.4	14.8	0.6
SNAP	17.1	0.3	19.3	0.5	16.6	0.4	15.4	0.6
Unemployment insurance	16.2	0.3	17.3	0.5	16.0	0.4	14.9	0.6
SSI	16.8	0.3	17.4	0.5	16.7	0.4	16.1	0.6
Housing subsidies	16.5	0.3	17.8	0.5	16.2	0.4	15.8	0.6
Child support received	16.0	0.3	17.4	0.5	15.7	0.4	14.7	0.6
School lunch	16.0	0.3	17.5	0.6	15.7	0.4	14.7	0.6
TANF/General Assistance	15.8	0.3	16.9	0.5	15.6	0.4	14.7	0.6
WIC	15.7	0.3	16.8	0.5	15.5	0.4	14.6	0.6
LJHEAP	15.6	0.3	16.5	0.5	15.5	0.4	14.7	0.6
Workers' compensation	15.6	0.3	16.5	0.5	15.5	0.4	14.6	0.6
SUBTRACTIONS								
Child support paid	15.4	0.3	16.3	0.5	15.3	0.4	14.6	0.6
Federal income tax	15.1	0.3	16.2	0.5	14.8	0.4	14.5	0.6
FICA	14.0	0.3	14.4	0.5	13.8	0.3	14.3	0.6
Work expenses	13.6	0.3	13.9	0.5	13.4	0.3	14.2	0.6
MOOP	12.0	0.3	13.3	0.5	12.3	0.3	8.3	0.5

¹ A 90 percent confidence interval is a measure of an estimate's variability. The larger the confidence interval in relation to the size of the estimate, the less reliable the estimate. Confidence intervals shown in this table are based on standard errors calculated using replicate weights. For more information see "Standard Errors and Their Use" at <http://ftp2.census.gov/library/publications/2014/demo/p60-249sa.pdf>.

² The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the redesigned set of health insurance coverage questions. The redesigned income questions were implemented to a subsample of these 98,000 addresses using a probability split panel design. Approximately 68,000 addresses were eligible to receive a set of income questions similar to those used in the 2013 CPS ASEC and the remaining 30,000 addresses were eligible to receive the redesigned income questions. The source of the 2013 data for this table is the portion of the CPS ASEC sample which received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses.

Source: U.S. Census Bureau, Current Population Survey, 2014 Annual Social and Economic Supplement.

resource measure for the 2 years and allows us to compare the effect of transfers, both cash and noncash, and nondiscretionary expenses on SPM rates. For most elements, the effect of additions and subtractions between the 2 years was not statistically different, however, some items had small differences in their effect on poverty rates. Tax credits and unemployment insurance had a smaller effect in 2013 than in 2012, while SSI was slightly more effective in reducing poverty rates. Payroll taxes (FICA) increased

poverty rates more.¹³ Several of these differences reflect increases in the number of individuals working year-round, full-time between 2012 and 2013, as noted in DeNavas-Walt et al. (2014). Other changes include declines in percentages of people in families receiving unemployment benefits (7.4 percent in 2012 and 6.1 percent in 2013) and changes to the tax code that increased the payroll

taxes that are subtracted from income in 2013.¹⁴

Changes in SPM Rates Between 2012 and 2013

As has been documented (DeNavas-Walt et al., 2014), real median household income was not changed between 2012 and 2013. Median total SPM resources were

¹⁴ There are two changes to the tax code incorporated into our tax simulation for 2013 that increased payroll tax estimates. The first is the expiration of a 2 percent reduction in Old-Age, Survivors, and Disability Insurance (OASDI) taxes for all employees and self-employed workers that returned the DASDI rate to 6.2 percent, instead of 4.2 percent as it had been in 2011 and 2012. The second is the implementation in 2013 of an additional Hospital Insurance tax of 0.9 percent on earned income exceeding \$200,000 for all individuals.

¹³ Federal income tax liabilities shown here are before refundable tax credits, the earned income tax credit, and the additional child tax credit, but include the nonrefundable child tax credit.

Table 5b.

Effect of Individual Elements on SPM Rates: 2012

(Confidence intervals [C.I.] in percentage points. Percent of people as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see www.census.gov/prod/techdoc/cps/cpsmar13.pdf)

Elements	All people		Under 18 years		18 to 64 years		65 years and over	
	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)	Estimate	90 percent C.I. ¹ (±)
Research SPM	16.0	0.3	18.0	0.5	15.5	0.3	14.8	0.5
ADDITIONS								
Social Security	24.5	0.3	20.0	0.5	19.6	0.3	54.7	0.7
Refundable tax credits	19.0	0.3	24.7	0.6	17.7	0.3	15.0	0.5
SNAP	17.6	0.3	21.0	0.5	16.7	0.3	15.6	0.5
Unemployment insurance	16.8	0.3	18.8	0.5	16.4	0.3	15.1	0.5
SSI	17.1	0.3	18.9	0.5	16.6	0.3	16.0	0.5
Housing subsidies	16.9	0.3	19.4	0.5	16.1	0.3	16.0	0.5
Child support received	16.4	0.3	19.0	0.5	15.8	0.3	14.9	0.5
School lunch	16.4	0.3	18.9	0.5	15.7	0.3	14.9	0.5
TANF/General Assistance	16.2	0.3	18.5	0.5	15.6	0.3	14.9	0.5
WIC	16.1	0.3	18.3	0.5	15.6	0.3	14.8	0.5
LIHEAP	16.1	0.3	18.1	0.5	15.5	0.3	14.9	0.5
Workers' compensation	16.1	0.3	18.1	0.5	15.6	0.3	14.9	0.5
SUBTRACTIONS								
Child support paid	15.9	0.3	17.8	0.5	15.3	0.3	14.8	0.5
Federal income tax	15.6	0.3	17.7	0.5	14.9	0.3	14.6	0.5
FICA	14.8	0.3	16.4	0.5	14.3	0.3	14.6	0.5
Work expenses	14.1	0.3	15.4	0.5	13.5	0.3	14.4	0.5
MOOP	12.6	0.3	14.9	0.5	12.6	0.3	8.4	0.4

¹ A 90 percent confidence interval is a measure of an estimate's variability. The larger the confidence interval in relation to the size of the estimate, the less reliable the estimate. Confidence intervals shown in this table are based on standard errors calculated using replicate weights. For more information see "Standard Errors and Their Use" at www.census.gov/hhes/www/p80_245aa.pdf.

Source: U.S. Census Bureau, Current Population Survey, 2013 Annual Social and Economic Supplement.

\$37,295 for 2012 (in 2013 dollars) and \$37,116 in 2013, not statistically different. Despite increased official poverty thresholds, there was a decline in the official poverty rate. Both the official and the SPM rates declined by 0.5 percentage points between 2012 and 2013.

Table 6 shows SPM rates for 2012 and 2013, calculated in a comparable way for each year. In 2013, the percent poor using the SPM was 15.5 percent, and in 2012 that rate was 16.0 percent. While for most groups there were no changes in SPM rates across the 2 years, there were small increases for those with private health insurance and declines for those with public insurance and the uninsured. Changes to the 2014 CPS ASEC questionnaire about health insurance premiums and other out-of-pocket costs may

be reflected in the 2013 rates by health insurance status.¹⁵

SPM rates also declined for several groups including children, those in married-couple families, Hispanics, the foreign born, noncitizens, renters, and those residing inside principal cities or in the Northeast. There were declines in the official measure for most of these groups including females, children, those in married-couple families, Hispanics, the foreign born, and noncitizens (DeNavas-Walt et al., 2014). All other groups in Table 6 showed no change in SPM rates between 2012 and 2013.

Finally, we show the official measure and the SPM over the 5 years for which we have estimates. Figure 5 shows the official measure

and the SPM across 4 years. Figure 6 shows the poverty rate using both measures for children and for those over 64 years.¹⁶

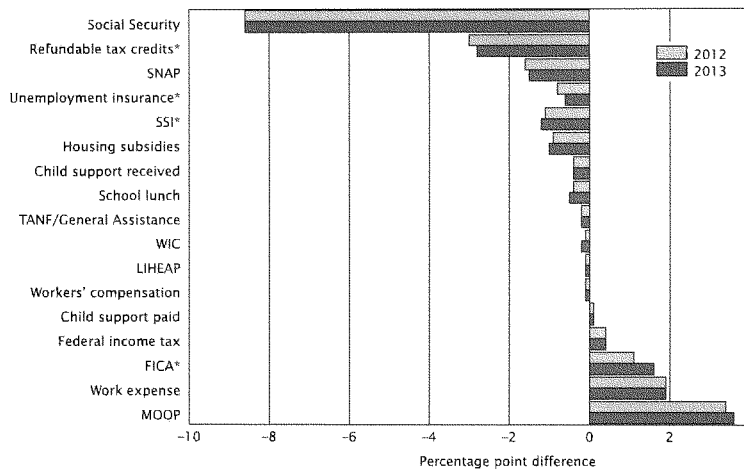
SUMMARY

This report provides estimates of the Supplemental Poverty Measure for the United States. The results shown illustrate differences between the official measure of poverty and a poverty measure that takes account of noncash benefits received by families and nondiscretionary expenses that they must pay. The SPM also employs a new poverty threshold that is updated with information on expenditures for FCSU by the BLS. Results showed higher poverty rates using the SPM than the official measure for most groups.

¹⁵ See Janicki (2014) and Smith and Medalla (2014) for more details on questionnaire changes to the 2014 ASEC.

¹⁶ For SPM estimates from 1967 to 2012, see Fox et al. (2013).

Figure 4.
Difference in SPM Rates After Including Each Element: 2012 and 2013



*Statistically significant change between 2012 and 2013.

Source: U.S. Census Bureau, Current Population Survey, 2013 and 2014 Annual Social and Economic Supplements.

The SPM allows us to examine the effects of taxes and noncash transfers on the poor and on important groups within the poverty population. As such, there are lower percentages of the SPM poverty populations in the very high and very low resource categories than we find using the official measure. Since noncash benefits help those in extreme poverty, there were lower percentages of individuals with resources below half the SPM threshold for most groups. In addition, the effects of benefits received from each program and taxes and other nondiscretionary expenses on SPM rates were examined.

These findings are similar to those reported in earlier work using a variety of experimental poverty measures that followed recommendations of the National Academy

of Sciences (NAS) poverty panel (Short et al., 1999 and Short, 2001). Experimental poverty rates based on the NAS panel's recommendations have been calculated every year since 1999. While SPM rates are available only from 2009, estimates are available for earlier years for a variety of experimental poverty measures, including the most recent for 2013.¹⁷ They include poverty rates that employ CE-based thresholds, as well as thresholds that increase each year from 1999 based on changes in the Consumer Price Index (similar to the official thresholds) and estimates that do not adjust thresholds for geographic differences in housing costs. However, the methods

used for many of the elements in the experimental measures differ markedly from those in the SPM and, therefore, they are not considered to be comparable measures.

RESEARCH FOR THE SPM

The ITWG was charged with developing a set of initial starting points to permit the Census Bureau, in cooperation with the BLS, to produce the SPM that would be released along with the official measure each year. In addition to specifying the nature and use of the SPM, the ITWG laid out a research agenda for many of the elements of this new measure. They stated:

As with any statistic regularly published by a Federal statistical agency, the Working Group

¹⁷ These estimates are available on the Census Bureau Web site, <www.census.gov/hhes/povmeas/data/nas/index.html>.

Table 6.

Percentage of People in Poverty Using the Supplemental Poverty Measure: 2012 and 2013

(Numbers in thousands, confidence intervals [C.I.] in thousands or percentage points as appropriate. People as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see [ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf](http://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf))

Characteristic	SPM 2013 ¹				SPM 2012				Difference	
	Number		Percent		Number		Percent			
	Estimate	90 per- cent C.I. ¹ (±)	Estimate	90 per- cent C.I. ¹ (±)	Estimate	90 per- cent C.I. ¹ (±)	Estimate	90 per- cent C.I. ¹ (±)	Number	Percent
All people	46,671	1,051	15.5	0.3	49,730	923	16.0	0.3	-1,059	*-0.5
Sex										
Male	22,839	593	14.9	0.4	23,278	474	15.3	0.3	-439	-0.4
Female	25,832	581	16.2	0.4	26,452	534	16.7	0.3	-620	-0.5
Age										
Under 18 years	12,177	388	16.4	0.5	13,358	366	18.0	0.5	*-1,181	*-1.6
18 to 64 years	29,987	700	15.4	0.4	29,953	584	15.5	0.3	34	-0.1
65 years and older	6,507	271	14.6	0.6	6,419	217	14.8	0.5	88	-0.2
Type of Unit										
Married couple	17,855	709	9.5	0.4	18,703	668	10.0	0.4	-848	*-0.5
Female householder	17,959	652	28.5	0.9	18,137	577	28.9	0.8	-178	-0.4
Male householder	7,853	394	23.1	1.1	7,766	291	23.1	0.7	87	Z
New SPM unit	5,004	379	17.9	1.3	5,124	360	18.4	1.1	-120	-0.5
Race² and Hispanic Origin										
White	33,445	818	13.7	0.3	34,002	724	14.0	0.3	-557	-0.3
White, not Hispanic	20,946	668	10.7	0.3	20,946	596	10.7	0.3		Z
Black	10,056	498	24.7	1.2	10,363	415	25.8	1.0	-307	-1.0
Asian	2,800	260	16.4	1.5	2,737	213	16.7	1.2	64	-0.2
Hispanic (any race)	14,085	556	26.0	1.0	14,819	450	27.8	0.8	-733	*-1.9
Nativity										
Native born	38,928	949	14.3	0.3	39,538	837	14.6	0.3	-610	-0.3
Foreign born	9,743	427	23.8	0.9	10,192	367	25.4	0.7	-449	*-1.7
Naturalized citizen	3,356	204	17.5	1.0	3,361	195	18.5	0.9	-5	-0.9
Not a citizen	6,387	366	29.2	1.3	6,831	307	31.2	1.1	-444	*-2.0
Tenure										
Owner	20,504	761	9.8	0.4	20,512	604	9.9	0.3	-8	-0.1
Owner/mortgage	11,267	569	8.3	0.4	11,676	443	8.5	0.3	-409	-0.2
Owner/no mortgage/rent free	9,970	524	13.1	0.6	9,694	402	13.4	0.5	276	-0.2
Renter	27,434	855	27.1	0.7	28,360	747	28.1	0.7	-926	*-1.1
Residence										
Inside metropolitan statistical areas	42,452	1,052	15.9	0.4	43,064	956	16.4	0.3	-613	-0.4
Inside principal cities	20,516	760	20.1	0.6	21,401	667	21.1	0.6	-885	*-1.1
Outside principal cities	21,936	819	13.4	0.4	21,664	701	13.4	0.4	272	Z
Outside metropolitan statistical areas ³	6,220	586	13.2	0.9	6,666	478	13.9	0.7	-446	-0.8
Region										
Northeast	7,947	490	14.3	0.9	8,570	362	15.5	0.7	*-624	*-1.2
Midwest	8,351	416	12.5	0.6	8,268	382	12.4	0.6	82	Z
South	18,565	705	15.9	0.6	18,939	605	16.3	0.5	-374	-0.5
West	13,809	495	18.7	0.7	13,953	473	19.0	0.6	-144	-0.3
Health Insurance Coverage										
With private insurance	16,439	604	8.2	0.3	15,273	446	7.7	0.2	*1,166	*0.5
With public, no private insurance	20,032	681	28.5	0.8	19,655	559	30.5	0.7	376	*-2.1
Not insured	12,201	468	29.1	1.0	14,802	449	30.9	0.8	*-2,601	*-1.8

See footnotes at end of table.

Table 6.

Percentage of People in Poverty Using the Supplemental Poverty Measure: 2012 and 2013—Con.

(Numbers in thousands, confidence intervals [C.I.] in thousands or percentage points as appropriate. People as of March of the following year. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see [ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf](http://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf))

Characteristic	SPM 2013 ¹				SPM 2012				Difference	
	Number		Percent		Number		Percent			
	Estimate	90 per- cent C.I. ¹ (±)	Estimate	90 per- cent C.I. ¹ (±)	Estimate	90 per- cent C.I. ¹ (±)	Estimate	90 per- cent C.I. ¹ (±)	Number	Percent
Work Experience										
Total, 18 to 64 years	29,987	700	15.4	0.4	29,953	584	15.5	0.3	34	-0.1
All workers	14,357	447	9.8	0.3	14,066	358	9.6	0.2	292	0.2
Worked full-time, year-round	5,479	214	5.4	0.2	5,252	183	5.3	0.2	228	0.1
Less than full-time, year-round	8,878	353	19.6	0.7	8,814	275	18.7	0.5	64	0.8
Did not work at least 1 week	15,630	504	32.2	0.8	15,887	390	33.2	0.7	-258	-1.0
Disability Status⁴										
Total, 18 to 64 years	29,987	700	15.4	0.4	29,953	584	15.5	0.3	34	-0.1
With a disability	4,126	235	27.3	1.2	3,979	167	26.5	0.9	147	0.8
With no disability	25,799	649	14.4	0.4	25,921	536	14.6	0.3	-123	-0.2

Z Represents or rounds to zero.

¹ An asterisk preceding an estimate indicates change is statistically different from zero at the 90 percent confidence level.

² A 90 percent confidence interval is a measure of an estimate's variability. The larger the confidence interval in relation to the size of the estimate, the less reliable the estimate. Confidence intervals shown in this table are based on standard errors calculated using replicate weights. For more information see "Standard Errors and Their Use" at <http://ftp2.census.gov/library/publications/2014/demo/p60-249sa.pdf>.

³ The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the redesigned set of health insurance coverage questions. The redesigned income questions were implemented to a subsample of these 98,000 addresses using a probability split panel design. Approximately 68,000 addressees were eligible to receive a set of income questions similar to those used in the 2013 CPS ASEC and the remaining 30,000 addresses were eligible to receive the redesigned income questions. The source of the 2013 data for this table is the portion of the CPS ASEC sample which received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses.

⁴ Federal surveys give respondents the option of reporting more than one race. Therefore, two basic ways of defining a race group are possible. A group such as Asian may be defined as those who reported Asian and no other race (the race-alone or single-race concept) or as those who reported Asian regardless of whether they also reported another race (the race-alone-or-in-combination concept). This table shows data using the first approach (race alone). The use of the single-race population does not imply that it is the preferred method of presenting or analyzing data. The Census Bureau uses a variety of approaches. Information on people who reported more than one race, such as White and American Indian and Alaska Native or Asian and Black or African American, is available from Census 2010 through American FactFinder. About 2.9 percent of people reported more than one race in Census 2010. Data for American Indians and Alaska Natives, Native Hawaiians and Other Pacific Islanders, and those reporting two or more races are not shown separately.

⁵ The "Outside metropolitan statistical areas" category includes both micropolitan statistical areas and territory outside of metropolitan and micropolitan statistical areas. For more information, see "About Metropolitan and Micropolitan Statistical Areas" at www.census.gov/population/metro/.

⁶ The sum of those with and without a disability does not equal the total because disability status is not defined for individuals in the Armed Forces.

Source: U.S. Census Bureau, Current Population Survey, 2013 and 2014 Annual Social and Economic Supplements.

expects that changes in this measure over time will be decided upon in a process led by research methodologists and statisticians within the Census Bureau in consultation with BLS and with other appropriate data agencies and outside experts, and will be based on solid analytical evidence.

Among the elements designated by the ITWG for further development were methods to include

noncash benefits in the thresholds, improving geographic adjustments for price differences across areas, improving methods to estimate work-related expenses (commuting costs), and evaluating methods for subtracting MOOP expenses having to do with the uninsured.

REFERENCES

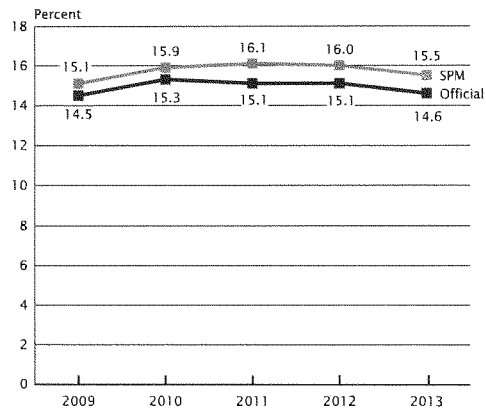
Many of the Poverty Measurement Working Papers listed below are available at:

www.census.gov/hhes/povmeas/publications/working.html or <http://stats.bls.gov/pir/spmhome.htm>.

Betson, David, "Is Everything Relative? The Role of Equivalence Scales in Poverty Measurement," University of Notre Dame, Poverty Measurement Working Paper, U.S. Census Bureau, 1996.

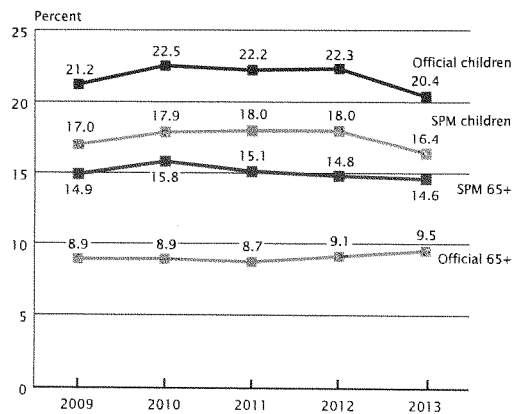
Bridges, Benjamin and Robert V. Gesumaria, "The Supplemental

Figure 5.
Poverty Rates Using the Official Measure and
the SPM: 2009 to 2013



Source: U.S. Census Bureau, Current Population Survey, 2010 to 2014 Annual Social and Economic Supplements.

Figure 6.
Poverty Rates Using the Official Measure and
the SPM for Two Age Groups: 2009 to 2013



Source: U.S. Census Bureau, Current Population Survey, 2010 to 2014 Annual Social and Economic Supplements.

Poverty Measure and the Aged: How and Why the SPM and Official Poverty Estimates Differ," Social Security Bulletin, 2013, Vol. 73, No. 4.

Bureau of Labor Statistics (BLS), "2013 Supplemental Poverty Measure Thresholds Based on Consumer Expenditure Survey Data," Washington, DC, September 10, 2013. Available at <www.bls.gov/pir/spm/spm_thresholds_2012.htm>.

Caswell, Kyle and Kathleen Short, "Medical Out-of-Pocket Spending of the Uninsured: Differential Spending and the Supplemental Poverty Measure," presented at the Joint Statistical Meetings, Miami, Florida, August 2011, Poverty Measurement Working Paper, U.S. Census Bureau.

Citro, Constance F., and Robert T. Michael (eds.), *Measuring Poverty: A New Approach*, Washington, DC: National Academy Press, 1995.

DeNavas-Walt, Carmen, and Bernadette D. Proctor, "Income and Poverty in the United States: 2013," U.S. Census Bureau, *Current Population Reports*, P60-249, U.S. Government Printing Office, Washington DC, September 2014.

Edwards, Ashley, Brian McKenzie, and Kathleen Short, "Work-related Expenses in the Supplemental Poverty Measure, January 2014," <www.census.gov/hhes/povmeas/publications/SGEworkexpense.pdf>.

Fox, Liana, Irwin Garfinkel, Neerah Kaushel, Jane Waldfogel, and Christopher Wimer, "Waging War on Poverty: Historical Trends in Poverty Using the Supplemental

- Poverty Measure," CPRC Working Paper 13-10, 2013.
- ITWG. "Observations from the Inter-agency Technical Working Group on Developing a Supplemental Poverty Measure," March 2010. Available at <www.census.gov/hhes/www/poverty/SPM_TWGObservations.pdf>.
- Janicki, Hubert, "Medical Out-of-Pocket Expenses in the 2013 and 2014 CPS ASEC," SEHSD Working Paper, September 2014.
- Johnson, Paul, Trudi Renwick, and Kathleen Short. "Estimating the Value of Federal Housing Assistance for the Supplemental Poverty Measure," Poverty Measurement Working Paper, U.S. Census Bureau, 2010.
- Renwick, Trudi, Bettina Aten, Eric Figuoria, and Troy Martin, "The Supplemental Poverty Measure Using Regional Price Parities to Adjust Poverty Thresholds," March 2013, <www.census.gov/hhes/povmeas/methodology/supplemental/research/SPMUsingRPPs.pdf>.
- Renwick, Trudi. "Geographic Adjustments of Supplemental Poverty Measure Thresholds: Using the American Community Survey Five-Year Data on Housing Costs," SEHSD Working Paper Number 2011-21, U.S. Census Bureau, 2011.
- Short, Kathleen, "The Research Supplemental Poverty Measure: 2012," U.S. Census Bureau, P60-247, *Current Population Reports*, November 2013, <www.census.gov/prod/2013pubs/p60-247.pdf>.
- Short, Kathleen, "The Research Supplemental Poverty Measure: 2011," U.S. Census Bureau, P60-244, *Current Population Reports*, November 2012, <www.census.gov/hhes/povmeas/methodology/supplemental/research/Short_ResearchSPM2011.pdf>.
- Short, Kathleen, "The Research Supplemental Poverty Measure: 2010," U.S. Census Bureau, P60-241, *Current Population Reports*, November 2011, <www.census.gov/hhes/povmeas/methodology/supplemental/research/Short_ResearchSPM2010.pdf>.
- Short, Kathleen, "Experimental Poverty Measures: 1999," U.S. Census Bureau, P60-216, *Current Population Reports*, "Consumer Income," U.S. Government Printing Office, Washington, DC, 2001.
- Short, Kathleen, Thesia Garner, David Johnson, and Patricia Doyle, "Experimental Poverty Measures: 1990 to 1997," U.S. Census Bureau, P60-205, *Current Population Reports*, "Consumer Income," U.S. Government Printing Office, Washington, DC, 1999.
- Smith, Jessica C., and Carla Medalia, "Health Insurance Coverage in the United States: 2013," U.S. Census Bureau, P60-250, *Current Population Reports*, U.S. Government Printing Office, Washington, DC, 2014.

APPENDIX—SPM METHODOLOGY

Poverty Thresholds

Consistent with the NAS panel recommendations and the suggestions of the ITWG, the SPM thresholds are based on out-of-pocket spending on food, clothing, shelter, and utilities (FCSU). Five years of Consumer Expenditure Survey (CE) data for consumer units with exactly two children (regardless of relationship to the family) are used to create the estimation sample. Unmarried partners and those who share expenses with others in the household are included in the consumer unit. FCSU expenditures are converted to adult equivalent values using a three-parameter equivalence scale (see next page for description). The

average of the FCSU expenditures defining the 30th and 36th percentile of this distribution is multiplied by 1.2 to account for additional basic needs. The three-parameter equivalence scale is applied to this amount to produce an overall threshold for a unit composed of two adults and two children.

To account for differences in housing costs, a base threshold for all consumer units with two children was calculated, and then the overall shelter and utilities portion was replaced by what consumer units with different housing statuses spend on shelter and utilities. Three housing status groups were determined and their expenditures

on shelter and utilities produced within the 30–36th percentiles of FCSU expenditures. The three groups are: owners with mortgages, owners without mortgages, and renters.

Equivalence Scales

The ITWG guidelines state that the "three-parameter equivalence scale" is to be used to adjust reference thresholds for the number of adults and children. The three-parameter scale allows for a different adjustment for single parents (Betson, 1996). This scale has been used in several BLS and Census Bureau studies (Short et al., 1999; Short,

2001). The three-parameter scale is calculated in the following way:

One and two adults:

$$scale = (adults)^{0.5}$$

Single parents:

$$scale = (adults + 0.8 * first\ child + 0.5 * other\ children)^{0.7}$$

All other families:

$$scale = (adults + 0.5 * children)^{0.7}$$

In the calculation used to produce thresholds for two adults, the scale is set to 1.41. The economy of scale factor is set at 0.70 for other family types. The NAS panel recommended a range of 0.65 to 0.75.

Geographic Adjustments

The American Community Survey (ACS) is used to adjust the FCSU thresholds for differences in prices across geographic areas. The geographic adjustments are based on 5-year ACS estimates of median gross rents for two-bedroom apartments with complete kitchen and plumbing facilities. Separate medians were estimated for each of the 264 metropolitan statistical areas (MSAs) large enough to be identified on the public-use version of the CPS ASEC file. This results in 358 adjustment factors. For each state, a median is estimated for all nonmetro areas (48), for each MSA with a population above the CPS ASEC limit (264), and for a combination of all other metro areas within a state (46). For details, see Renwick (2011).¹⁸

Unit of Analysis

The ITWG suggested that the "family unit" include all related individuals who live at the same address, any coresident unrelated children who are cared for by the family (such as foster children), and any

cohabiters and their children.¹⁹

This definition corresponds broadly with the unit of data collection (the consumer unit) that is employed for the CE data that are used to calculate poverty thresholds. They are referred to as *SPM Resource Units* and include units that added a cohabiter, an unrelated individual under 15 years of age, a foster child aged 15 to 21, or an unmarried parent of a child in the family. Note that some units change for more than one of these reasons. Further, sample weights differ due to forming these units of analysis. For all new family units that have a set of male/female partners, the female partner's weight is used as the SPM family weight. For all other new units, there is no change.²⁰

Noncash Benefits

Supplemental Nutrition Assistance Program (SNAP)

SNAP benefits (formerly known as food stamps) are designed to allow eligible low-income households to afford a nutritionally adequate diet. Households that participate in the SNAP program are assumed to devote 30 percent of their countable monthly cash income to the purchase of food, and SNAP benefits make up the remaining cost of an adequate low-cost diet. This amount is set at the level of the U.S. Department of Agriculture's Thrifty Food Plan. In the CPS, respondents report if anyone in the household ever received SNAP benefits in the previous calendar year and, if so, the face value of those benefits. The annual household amount is prorated to SPM Resource Units within each household.

¹⁹ Foster children up to the age of 22 are included in the new unit.

²⁰ Appropriate weighting of these new units is an area of additional research at the Census Bureau.

National School Lunch Program

This program offers children free school lunches if family income is below 130 percent of federal poverty guidelines, reduced-price school meals if family income is between 130 and 185 percent of the federal poverty guidelines, and a subsidized school meal for all other children. In the CPS, the reference person is asked how many children 'usually' ate a complete lunch at school, and if it was a free or reduce-priced school lunch. Since we have no further information, the value of school meals is based on the assumption that the children received the lunches every day during the last school year. Note that this method may overestimate the benefits received by each family. To value benefits, we obtain amounts on the cost per lunch from the Department of Agriculture Food and Nutrition Service, which administers the school lunch program. There is no value included for school breakfast.²¹

Supplementary Nutrition Program for Women, Infants, and Children (WIC)

This program is designed to provide food assistance and nutritional screening to low-income pregnant and postpartum women and their infants and to low-income children up to age 5. Incomes must be at or below 185 percent of the poverty guidelines, and participants must be nutritionally at-risk (having abnormal nutritional conditions, nutrition-related medical

²¹ In the Survey of Income and Program Participation (SIPP), respondents report the number of breakfasts eaten by the children per week, similar to the report of school lunches. Calculating a value for this subsidy in the same way as was done for the school lunch program yielded an amount of approximately \$2.8 billion for all families in the SIPP for the year 2004. For information on confidentiality protection, sampling error, nonsampling error, and definitions, for the 2004 SIPP, see <www.census.gov/sipp/> accessed September 2013.

conditions, or dietary deficiencies). Benefits include supplemental foods in the form of food items or vouchers for purchases of specific food items. There are questions on current receipt of WIC in the CPS. Lacking additional information, we assume 12 months of participation and value the benefit using program information obtained from the Department of Agriculture. As with school lunch, assuming yearlong participation may overestimate the value of WIC benefits received by a given SPM family. In these estimates, we assume that all children less than 5 years of age in a household where someone reports receiving WIC are also assigned receipt of WIC. If the child is aged 0 or 1 year, then we assume that the mother also gets WIC. If there is no child in the family but the household reference person said "yes" to the WIC question, we assume this is a pregnant woman receiving WIC.

The 2014 CPS ASEC traditional survey instrument did not work properly when asking about WIC benefits and did not collect any information about the receipt of WIC in the calendar year 2013. To remedy this problem, a Monte Carlo approach was used to provide the missing data. Thus, all WIC information was imputed and the imputation flag was set to "1." The Monte Carlo method used the following information to generate responses:

- Sex (women only)
- Age (15–45; 46 and over)
- Presence of a child under age 5
- Participation in other means-tested programs (TANF, SSI, rental subsidy, food stamps)
- Receipt of WIC in the previous year (based on CPS ASEC sample overlap)

- Change between 2012 and 2013 in administrative roles

Based on a probability function using the noted characteristics and a random number generator, if the random number was less than the probability target, WIC was assigned.

Low-Income Home Energy Assistance Program (LIHEAP)

This program provides three types of energy assistance. Under this program, states may help pay heating or cooling bills, provide allotments for low-cost weatherization, or provide assistance during energy-related emergencies. States determine eligibility and can provide assistance in various ways, including cash payments, vendor payments, two-party checks, vouchers/coupons, and payments directly to landlords. In the CPS ASEC, the question on energy assistance asks for information about the entire year and captures assistance for cooling paid in the summer months or emergency benefits paid after the February/March/April survey date. Many households receive both a "regular" benefit and one or more crisis or emergency benefits. Additionally, since LIHEAP payments are often made directly to a utility company or fuel oil vendor, many households may have difficulty reporting the precise amount of the LIHEAP payment made on their behalf.

Housing Assistance

Households can receive housing assistance from a plethora of federal, state, and local programs. Federal housing assistance consists of a number of programs administered primarily by the Department of Housing and Urban Development (HUD). These programs traditionally take the form of rental subsidies and mortgage-interest subsidies

targeted to very-low-income renters and are either project-based (public housing) or tenant-based (vouchers). The value of housing subsidies is estimated as the difference between the "market rent" for the housing unit and the total tenant payment. The "market rent" for the household is estimated using a statistical match with (HUD) administrative data from the Public and Indian Housing Information Center and the Tenant Rental Assistance Certification System (TRACS). For each household identified in the CPS ASEC as receiving help with rent or living in public housing, an attempt was made to match on state, Core-Based Statistical Area, and household size.²² The total tenant payment is estimated using the total income reported by the household on the CPS ASEC and HUD program rules. Generally, participants in either public housing or tenant-based subsidy programs administered by HUD are expected to contribute the greater of one-third of their "adjusted" income or 10 percent of their gross income towards housing costs.²³ See Johnson et al. (2010) for more details on this method. Initially, subsidies

²² HUD operates two major housing assistance programs: public housing and tenant-based or voucher programs. Since the HUD administrative data include only estimates of gross or contract rent for tenant-based housing assistance programs, the contract rents assigned to CPS ASEC households living in public housing are adjusted by a factor derived from data published in the "Picture of Subsidized Households" that estimates the average tenant payment and the average subsidy by type of assistance. The average contract rent would be the sum of these two estimates, see <www.huduser.org/portal/datasets/picture/yearlydata.html> accessed August 2014.

²³ HUD regulations define "adjusted household income" as cash income excluding income from certain sources minus numerous deductions. Three of the income exclusions can be identified from the CPS ASEC: income from the employment of children, student financial assistance, and earnings in excess of \$480 for each full-time student 18 years or older. Deductions that can be modeled from the CPS ASEC include: \$480 for each dependent, \$400 for any elderly or disabled family member, child care, and medical expenses.

are estimated at the household level. If there is more than one SPM family in a household, then the value of the subsidy is prorated based on the number of people in the SPM family relative to the total number of people in the household.

Housing subsidies help families pay their rent and as such are added to income for the SPM. However, there is general agreement that, while the value of a housing subsidy can free up a family's income to purchase food and other basic items, it will do so only to the extent that it meets the need for shelter. Thus, the values for housing subsidies included as income are limited to the proportion of the threshold that is allocated to housing costs. The subsidy is capped at the housing portion of the appropriate threshold MINUS the total tenant payment.

Necessary Expenses Subtracted From Resources

Taxes

The NAS panel and the ITWG recommended that the calculation of family resources for poverty measurement should subtract necessary expenses that must be paid by the family. The measure subtracts federal, state, and local income taxes and Social Security payroll taxes (FICA) before assessing the ability of a family to obtain basic necessities such as food, clothing, shelter and utilities. Taking account of taxes allows us to account for receipt of the federal or state earned income credit (EITC) and other tax credits. The CPS ASEC does not collect information on taxes paid but relies on a tax calculator to simulate taxes paid. These simulations include federal and state income taxes and Social Security payroll taxes. These simulations also use a statistical match

to the Statistics of Income micro-data file of tax returns.

Work-Related Expenses

Going to work and earning a wage often entails incurring expenses, such as travel to work and purchase of uniforms or tools. For work-related expenses (other than child care), the NAS panel recommended subtracting a fixed amount for each earner 18 years or over. Their calculation was based on 1987 Survey of Income and Program Participation (SIPP) data that collected information on work expenses in a set of supplementary questions. They calculated 85 percent of median weekly expenses —\$14.42 per week worked for anyone over 18 in the family in 1992. Total expenses were obtained by multiplying this fixed amount by the number of weeks respondents reported working in the year. Since the 1996 panel of SIPP, the work-related expenses topical module has been repeated every year.²⁴ Each person in the SIPP reports their own expenditures on work-related items in a given week. The most recent available data are used to calculate median weekly expenses. The number of weeks worked, reported in the CPS ASEC, is multiplied by the 85 percent of median weekly work-related expenses for each person to arrive at annual work-related expenses.²⁵

Child Care Expenses

Another important part of work-related expenses is paying someone to care for children while parents work. These expenses have become important for families with young children in which both

parents (or a single parent) work. To account for child care expenses while parents worked, in the CPS, parents are asked whether or not they pay for child care and how much they spent. The amounts paid for any type of child care while parents are at work are summed over all children. The NAS report recommended capping the amount subtracted from income, when combined with other work-related expenses, so that these do not exceed reported earnings of the lowest earner in the family. The ITWG also made this recommendation. This capping procedure is applied before determining poverty status.²⁶

Child Support Paid

The NAS panel recommended that, since child support received from other households is counted as income, child support paid out to those households should be deducted from the resources of those households that paid it. Without this subtraction, all child support is double counted in overall income statistics. New questions ascertaining amounts paid in child support are included in the CPS ASEC, and these reported amounts are subtracted in the estimates presented here.

Medical Out-of-Pocket (MOOP) Expenses

The ITWG recommended subtracting MOOP expenses from income, following the NAS panel. The NAS panel was aware that expenditures for health care are a significant portion of a family budget and have become an increasingly larger budget item since the 1960s. These expenses include the payment of

²⁴ The 2004 panel, wave 9 topical modules were not collected due to budget considerations.

²⁵ Edwards et al. (2014) examined alternative methods of valuing work-related expenses using the American Community Survey.

²⁶ Some analysts have suggested that this cap may be inappropriate in certain cases, such as if the parent is in school, looking for work, or receiving types of compensation other than earnings.

health insurance premiums plus other medically necessary items such as prescription drugs and doctor copayments that are not paid for by insurance. Subtracting these “actual” amounts from income, like taxes and work expenses, leaves the amount of income that the family has available to purchase the basic bundle of goods.

While many individuals and families have health insurance that covers most of the very large expenses, the typical family pays the costs of health insurance premiums and other small fees out-of-pocket. In these questions, respondents report expenditures on health insurance premiums that do not include Medicare Part B premiums. Medicare Part B premiums pose a particular problem for these estimates. The CPS ASEC instrument identifies when a respondent reported Social Security Retirement (SSR) benefits net of Medicare Part B premiums. For these respondents, a Part B premium set at the standard amount per month is automatically added to income. Corrections for these applied amounts are discussed in Caswell and Short (2011) and applied here. To be consistent with what is added

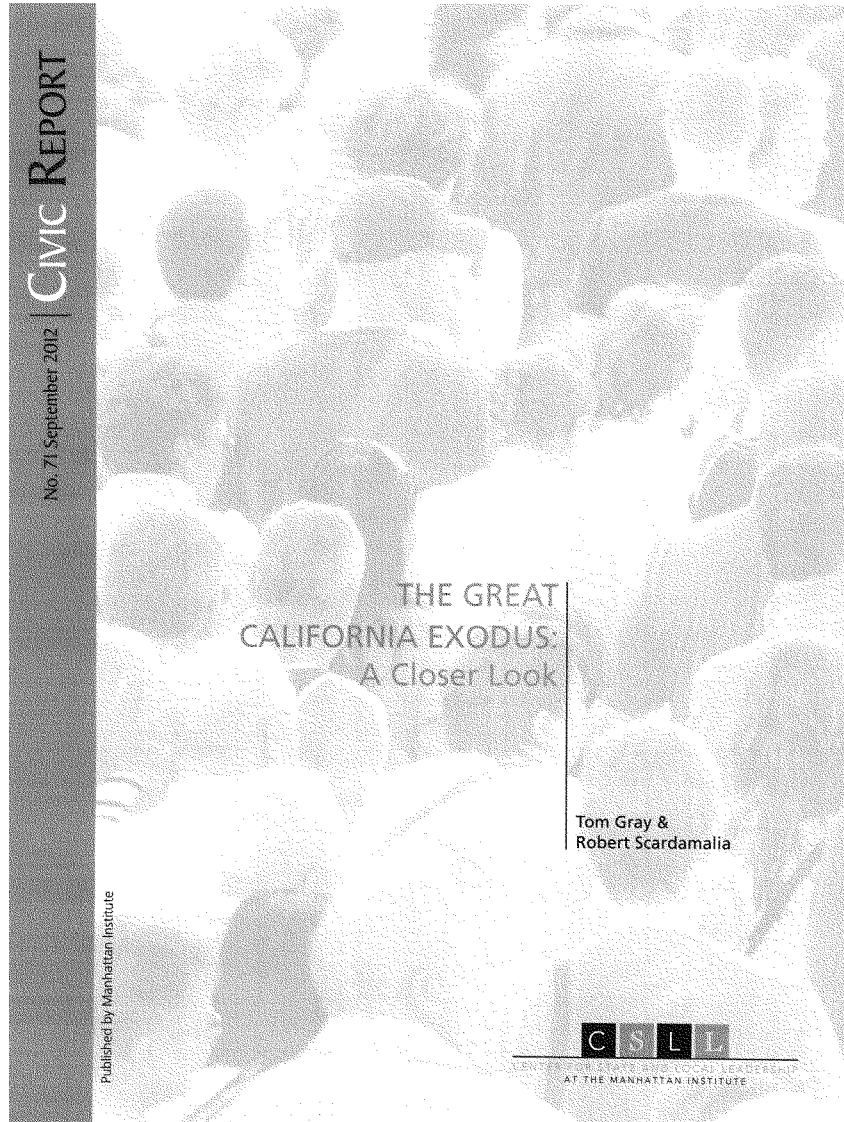
to the SSR income in these cases, the same amount is added to reported premium expenditures.²⁷ For the remaining respondents that report Medicare status, Medicare Part B premiums are simulated using the rules for income and tax filing status (Medicare.gov).²⁸ The simplifying assumption is made that married respondents with “spouse present” file married joint returns. For these cases, the combined reported income of both spouses is used to determine the appropriate Part B premium. Finally, it is assumed that the following two groups pay zero Part B premiums: (1) dual-eligible respondents (i.e., Medicare and Medicaid) and (2) those with a family income less than 135 percent of

the federal poverty level. The latter assumption is based on a rough estimate of eligibility and participation in at least one of the following programs: Qualified Medicare Beneficiary, Specified Low-Income Medicare Beneficiary, or Qualified Individual-1 (QI-1). We abstract from the possibility of (state-specific) asset requirements.

Changes were made to the questions about health insurance coverage and MOOP in the 2014 ASEC. Details about those changes can be found in Smith and Medalia (2014) and Janicki (2014).

²⁷ In these cases, it is important to assign an amount for Medicare Part B premiums that is equal to what is added to the resource side, (i.e., SSR income), of the poverty calculation. Note that the instrument calculation is done irrespective of Medicaid status, and therefore dual-enrollees who report “net” SSR income receive an estimate for Medicare Part B that is added to reported premiums.

²⁸ The CPS ASEC does not collect the number of months that a person was on Medicare; therefore, we make the simplifying assumption that respondents were insured for the entire year. Given this data limitation, this assumption is appropriate, as few individuals on Medicare transition out of Medicare.



CMC REPORT

No. 71 September 2012

THE GREAT CALIFORNIA EXODUS: A Closer Look

Tom Gray &
Robert Scardamalia

CSLL

AT THE MANHATTAN INSTITUTE

Published by Manhattan Institute

For decades after World War II, California was a destination for Americans in search of a better life. In many people's minds, it was the state with more jobs, more space, more sunlight, and more opportunity. They voted with their feet, and California grew spectacularly (its population increased by 137 percent between 1960 and 2010). However, this golden age of migration into the state is over. For the past two decades, California has been *sending* more people to other American states than it receives from them. Since 1990, the state has lost nearly 3.4 million residents through this migration.

This study describes the great ongoing California exodus, using data from the Census, the Internal Revenue Service, the state's Department of Finance, the Bureau of Labor Statistics, the Federal Housing Finance Agency, and other sources. We map in detail where in California the migrants come from, and where they go when they leave the state. We then analyze the data to determine the likely causes of California's decline and the lessons that its decline holds for other states.

The data show a pattern of movement over the past decade from California mainly to states in the western and southern U.S.: Texas, Nevada, and Arizona, in that order, are the top magnet states. Oregon, Washington, Colorado, Idaho, and Utah follow. Rounding out the top ten are two southern states: Georgia and South Carolina.

A finer-grained regional analysis reveals that the main current of migration out of California in the past decade has flowed eastward across the Colorado River, reversing the storied passages of the Dust Bowl era. Southern California had about 55 percent of the state's population in 2000 but accounted for about 65 percent of the net out-migration in the decade that followed. More than 70 percent of the state's net migration to Texas came from California's south.

What has caused California's transformation from a "pull in" to a "push out" state? The data have revealed several crucial drivers. One is chronic economic adversity (in most years, California unemployment is above the national average). Another is density: the Los Angeles and Orange County region now has a population density of 6,999.3 per square mile—well ahead of New York or Chicago. Dense coastal areas are a source of internal migration, as people seek more space in California's interior, as well as migration to other states. A third factor is state and local governments' constant fiscal instability, which sends at least two discouraging messages to businesses and individuals. One is that they cannot count on state and local governments to provide essential services—much less, tax breaks or other incentives. Second, chronically out-of-balance budgets can be seen as tax hikes waiting to happen.

The data also reveal the motives that drive individuals and businesses to leave California. One of these, of course, is work. States with low unemployment rates, such as Texas, are drawing people from California, whose rate is above the national average. Taxation also appears to be a factor, especially as it contributes to the business climate and, in turn, jobs. Most of the destination states favored by Californians have lower taxes. States that have gained the most at California's expense are rated as having better business climates. The data suggest that many cost drivers—taxes, regulations, the high price of housing and commercial real estate, costly electricity, union power, and high labor costs—are prompting businesses to locate outside California, thus helping to drive the exodus.

Population change, along with the migration patterns that shape it, are important indicators of fiscal and political health. Migration choices reveal an important truth: some states understand how to get richer, while others seem to have lost the touch. California is a state in the latter group, but it can be put back on track. All it takes is the political will.

ABOUT THE AUTHORS

Tom Gray is an award-winning editor, writer, and communications consultant whose work has covered a wide range of fields, including investor relations, personal finance, health care, engineering, leading-edge scientific research, and local, state, and national politics. In a career spanning four decades, he has written for publications such as the *Los Angeles Times*, *City Journal*, and *Investor's Business Daily* (where he also served as senior editor), and has authored three books on online investing published by John Wiley & Sons. As editorial-page editor of the *Los Angeles Daily News*, Gray won a number of awards for writing and editing including first place awards for editorial writing from the California Newspaper Publishers Association and the Inland Daily Press Association. He also has provided marketing and communications services for business and not-for-profit clients including Deloitte & Touche, ValueOptions Inc., the Kavli Foundation, the Synthetic Biology Institute at the University of California, Berkeley, and the University of California, Santa Barbara. A graduate with distinction from Stanford University, Gray also has master's degrees in English and business administration. He lives in Cambria, California.

Robert Scardamalia is president of RLS Demographics, Inc., a firm specializing in the use and analysis of economic and demographic data for private and public applications, and a data consultant for the Manhattan Institute's Empire Center for New York State Policy. He was formerly director of the Center for Research and Information Analysis in the New York State Department of Economic Development and served as chief demographer of the State of New York and director of the State Data Center. Scardamalia is a professional demographer and has more than 30 years of experience using Census and related data for marketing, business attraction, and public sector program management. He holds a bachelor's degree in sociology from Penn State University and a master's degree in demography from Georgetown University.

CONTENTS

1	Introduction
2	Setting the Scene
9	PART I: Where Californians Are Moving: IRS Data
19	PART II: Why Californians Are Moving: Analyzing the Data
24	Individuals' Reasons to Leave California
29	Conclusion: Why Migration Matters
31	APPENDIX: How IRS Data Is Used to Analyze Migration

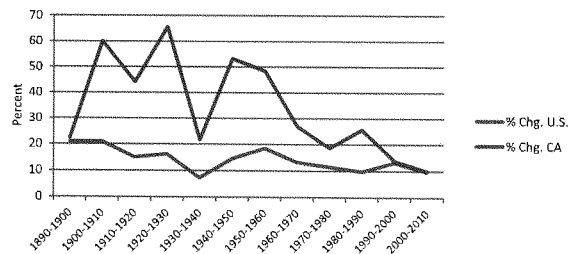
THE GREAT CALIFORNIA EXODUS: A CLOSER LOOK

Tom Gray &
Robert Scardamalia

INTRODUCTION

California was once a powerful draw for Americans on the move—a golden land, “west of the west,” in Theodore Roosevelt’s famous phrase, where everything could be better. But that California is no more. Around 1990, after decades of spectacular postwar growth, California began sending more people to other states than it got in return. Since that shift, its population has continued to grow (at a rate near the national average) only because of foreign immigration and a relatively high birthrate. Immigration from other nations, though, is declining, and it is likely that the state’s growth rate may soon fall behind that of the U.S. as a whole. As a magnet of opportunity, the state now pushes out where it once pulled in.

Chart 1: Percent Change in Population by Decade, U.S. and California, 1890–2010



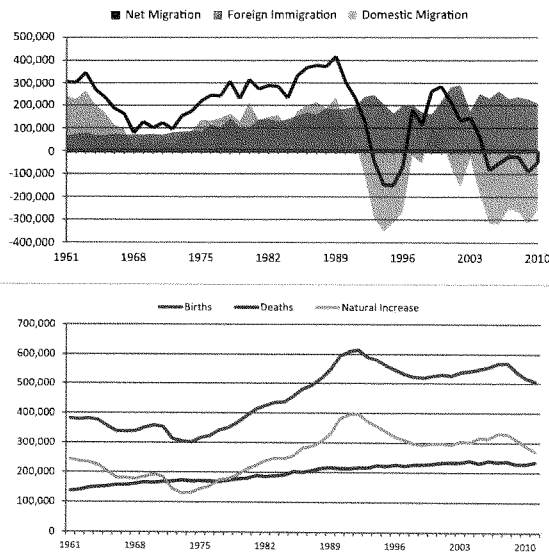
Source: U.S. Bureau of the Census

What are the reasons for this exodus, and what do they tell us about how American states thrive or decline? To understand how California the cherished destination turned into California the place to escape, this study examined data from a number of different sources that have tracked the great exodus of the past 20 years. We draw on the most recent data available from the Census, the Internal Revenue Service, the state's Department of Finance, the Bureau of Labor Statistics, the Federal Housing Finance Agency, and other sources. We have been able to use these sources to describe the exodus in unprecedented detail, revealing its drivers and suggesting things that other states can learn from California's continuing decline.

SETTING THE SCENE

California is a far more populous state than it was in 1960, when it was second to New York in population size, with 15,717,204 people. Since then, the state has grown 137 percent, to 37,253,956 in 2010. For comparison, consider New York, which grew by only 15 percent during that same period. On the other hand, Texas has grown faster over these 50 years—by 262 percent. As we'll see below, though, it's significant that Texas's record reflects a recent sprint. Until 2000, its growth matched California's rather than surpassing it.

Chart 2 & 3: Changes in California's Population, 1960–2010



California's domestic migration peaked before 1990 and then fell sharply, offset only in part by foreign immigration. Natural increase (bottom chart) has also declined

Sources: California Dept. of Finance for population, births and deaths except for July 2010 to July 2011 births and deaths; U.S. Dept. of Homeland Security for foreign immigration, 1960–88; U.S. Bureau of the Census for foreign immigration, 1989–2011; birth and death data for July 2010 to July 2011

Table 1: Components of California Population Change, 1960–2011

	State Dept. of Finance Pop. Estimate	12-Mo. Change	Births	Deaths	Natural Increase	Foreign Immigration	Domestic Migration	Net Migration
July 1, 1960	15,863,000							
July 1, 1961	16,412,000	549,000	381,000	137,000	244,000	64,205	240,795	305,000
July 1, 1962	16,951,000	539,000	378,000	141,000	237,000	72,675	229,325	302,000
July 1, 1963	17,530,000	579,000	381,000	148,000	233,000	79,090	266,910	346,000
July 1, 1964	18,026,000	496,000	375,000	151,000	224,000	67,407	204,593	272,000
July 1, 1965	18,464,000	438,000	355,000	153,000	202,000	67,671	168,329	236,000
July 1, 1966	18,831,000	367,000	338,000	157,000	181,000	73,073	112,927	186,000
July 1, 1967	19,175,000	344,000	337,000	157,000	180,000	69,150	94,850	164,000
July 1, 1968	19,432,000	257,000	339,000	161,000	178,000	72,371	6,629	79,000
July 1, 1969	19,745,000	313,000	351,000	166,000	185,000	71,183	56,817	128,000
July 1, 1970	20,039,000	294,000	358,000	165,000	193,000	74,268	26,732	101,000
July 1, 1971	20,346,000	307,000	352,000	168,000	184,000	69,825	53,175	123,000
July 1, 1972	20,585,000	239,000	313,000	169,000	144,000	80,121	14,879	95,000
July 1, 1973	20,869,000	284,000	303,000	173,000	130,000	84,664	69,336	154,000
July 1, 1974	21,174,000	305,000	301,000	170,000	131,000	86,699	87,301	174,000
July 1, 1975	21,538,000	364,000	316,000	171,000	145,000	83,061	135,939	219,000
July 1, 1976	21,936,000	398,000	323,000	170,000	153,000	113,164	131,836	245,000
July 1, 1977	22,352,000	416,000	342,000	168,000	174,000	98,401	143,599	242,000
July 1, 1978	22,836,000	484,000	350,000	173,000	177,000	143,544	163,456	307,000
July 1, 1979	23,257,000	421,000	368,000	177,000	191,000	99,774	130,226	230,000
July 1, 1980	23,782,000	525,000	390,000	180,000	210,000	100,769	214,231	315,000
July 1, 1981	24,278,000	496,000	413,000	189,000	224,000	136,938	135,062	272,000
July 1, 1982	24,805,000	527,000	425,000	186,000	239,000	138,962	149,038	288,000
July 1, 1983	25,337,000	532,000	435,000	188,000	247,000	127,312	157,688	285,000
July 1, 1984	25,816,000	479,000	437,000	191,000	246,000	139,413	93,587	233,000
July 1, 1985	26,403,000	587,000	457,000	202,000	255,000	154,525	177,475	332,000
July 1, 1986	27,052,000	649,000	481,000	200,000	281,000	167,896	200,104	368,000
July 1, 1987	27,717,000	665,000	493,000	206,000	287,000	160,393	217,607	378,000
July 1, 1988	28,393,000	676,000	517,000	214,000	303,000	187,828	185,172	373,000
July 1, 1989	29,142,000	749,000	547,000	216,000	331,000	180,930	237,070	418,000
July 1, 1990	29,828,000	686,000	594,000	213,000	381,000	186,225	118,775	305,000
July 1, 1991	30,459,000	631,000	609,000	213,000	396,000	194,317	40,683	235,000
July 1, 1992	30,987,000	528,000	613,000	216,000	397,000	238,281	-107,281	131,000
July 1, 1993	31,314,000	327,000	588,000	216,000	372,000	247,253	-292,253	-45,000
July 1, 1994	31,524,000	210,000	579,000	223,000	356,000	205,872	-351,872	-146,000
July 1, 1995	31,712,000	188,000	558,000	221,000	337,000	165,315	-314,315	-149,000
July 1, 1996	31,963,000	251,000	544,000	225,000	319,000	199,483	-267,483	-68,000
July 1, 1997	32,453,000	490,000	531,000	222,000	309,000	201,666	-20,666	181,000
July 1, 1998	32,863,000	410,000	522,000	226,000	296,000	169,541	-55,541	114,000
July 1, 1999	33,419,000	556,000	519,000	226,000	293,000	161,245	101,755	263,000
July 1, 2000	34,000,835	581,835	525,000	228,000	297,000	217,576	67,259	284,835

July 1, 2001	34,512,742	511,907	529,000	232,000	297,000	282,794	-67,887	214,907
July 1, 2002	34,938,290	425,548	526,000	233,000	293,000	291,191	-158,643	132,548
July 1, 2003	35,388,928	450,638	537,000	233,000	304,000	176,361	-29,723	146,638
July 1, 2004	35,752,765	363,837	540,000	239,000	301,000	252,889	-190,052	62,837
July 1, 2005	35,985,582	232,817	547,000	231,000	316,000	232,006	-315,189	-83,183
July 1, 2006	36,246,822	261,240	553,000	239,000	314,000	264,677	-317,437	-52,760
July 1, 2007	36,552,529	305,707	565,000	235,000	330,000	228,941	-253,234	-24,293
July 1, 2008	36,856,222	303,693	566,000	237,000	329,000	238,433	-263,740	-25,307
July 1, 2009	37,077,204	220,982	538,000	228,000	310,000	227,870	-316,888	-89,018
July 1, 2010	37,318,000	240,796	516,000	228,000	288,000	208,446	-255,650	-47,204
July 1, 2011	37,579,000	261,000	505,000	234,000	271,000	164,445	-174,445	-10,000

Sources: California Dept. of Finance for population, births, and deaths except for July 2010 to July 2011 births and deaths
U.S. Dept. of Homeland Security for foreign immigration based on fiscal year data for 1960 through 1988.
U.S. Bureau of the Census for foreign immigration 1989 through 2011. Birth and death data for July 2010 to July 2011

Since the watershed year of 1990, California's growth rate has slowed, and is now near the average for the United States as a whole. Moreover, the nature of Californian growth has changed. From 1960 to 1990, more than half of its population increase—54 percent, according to state Department of Finance estimates—was due to migration from other states or foreign countries. In this heyday of California's desirability to migrants, net domestic migration from within the U.S. alone totaled more than 4.2 million, or 30 percent of the overall growth. So in 30 years, California took in enough American migrants to populate the entire state of Missouri.

But then, as we have described, the appeal of California withered. Since 1990, domestic migration to California has flipped to a deficit. In the last two decades, the state lost nearly 3.4 million residents through migration to other states. In other words, it lost about four-fifths of what it had gained through domestic migration in the previous 30 years. Foreign immigration filled the gap only partially. Inflows from overseas peaked at 291,191 in 2002 and sank to just 164,445 in 2011. Meanwhile, net domestic out-migration has averaged 225,000 a year over the past ten years.

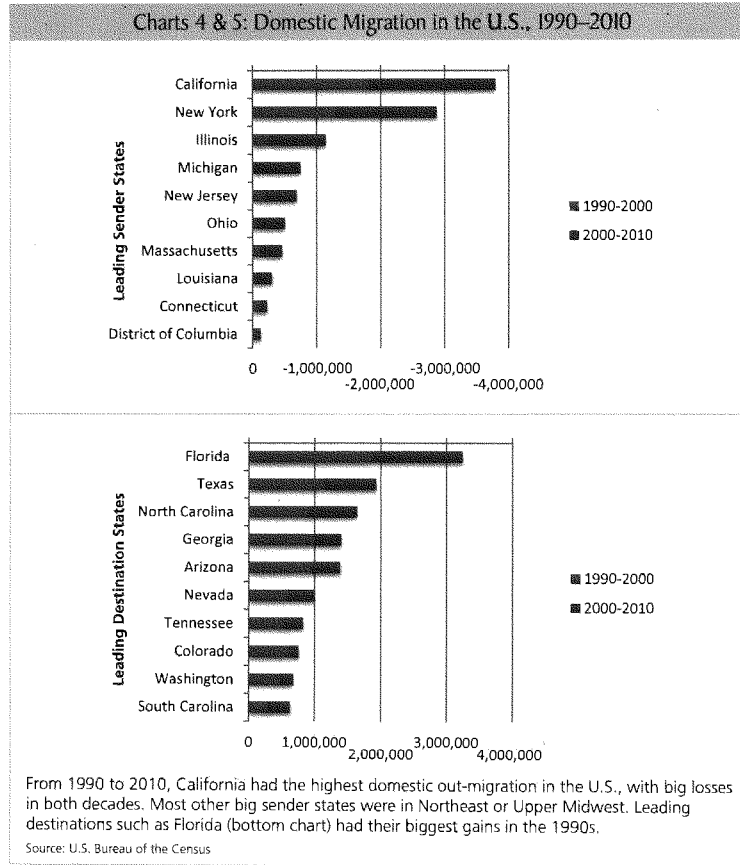
In 2005, foreign immigration ceased to make up for the drop in domestic migration to California. Since that year, California's annual net migration has been negative—more people leave the state than come to live in it. Natural increase in the resident popula-

tion—births minus deaths—cushions the blow of this out-migration, but that, too, is falling. It peaked at 397,000 in 1992 and had dropped to 271,000 by 2011. With continued low levels of fertility and the aging of the baby boomers, natural increase will continue to decline and, in some areas, may already have shifted to a natural decrease. If all these trends continue, California may find itself in a situation similar to that of New York and the states of the midwestern Rust Belt in the last century, which have seen populations stagnate for decades, or even fall.

Who were the big winners in the migration game when California was losing? The answer is the same for both decades since 1990—the Sun Belt giants Florida and Texas, followed by other fast-growing southern and western states. Migration overall declined somewhat from the 1990s to the 2000s, possibly reflecting the more troubled economy of the second decade, especially at its end.

The states with the largest net in-migrations generally had their biggest gains in the 1990s, though they all continued to attract Americans in the 2000s. Among the big losers, California (like number-two loser New York) shed residents at a consistently high pace for the whole 20 years. Most other big "sender states," such as Illinois, New Jersey, Ohio, and especially Michigan, saw their out-migration accelerate in the 2000s.

In the period we studied, California's out-migration was also high as a percentage of its population—6.11



percent in the 1990s and 5.8 percent in the 2000s. Just a handful of states had less success at keeping their residents. In the 2000s, for instance, only New York (8.27 percent), Michigan (7.12 percent), Illinois (7.09 percent), and New Jersey (5.86 percent) had higher out-migration rates. As that list suggests, California's migration patterns now have more in

common with large northeastern and Rust Belt states than with other Sun Belt or western states.

California is still contributing to the population boom of the southwestern U.S. but now seems to do so mainly by sending residents to neighboring states. The fastest-growing state in the nation, Nevada, is

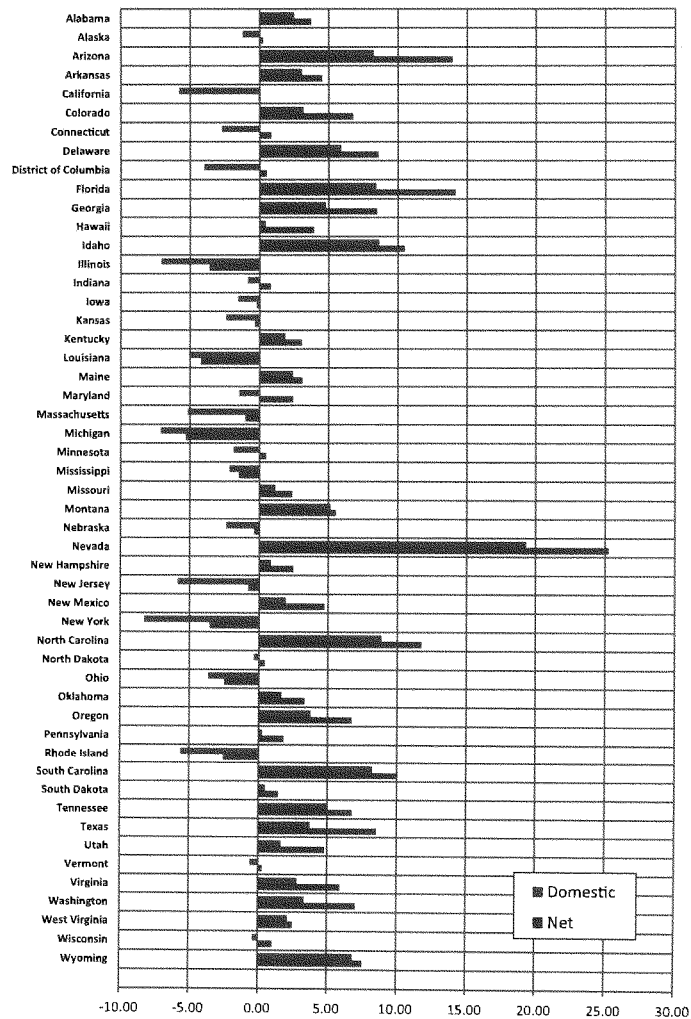
Table 2: Components of Migration, U.S. States, 1990-2010

	Number			Rate		
	1990s	2000s	Net	1990s	2000s	Net
Alabama	Foreign 17,105 Domestic 194,784 Net 211,888	Foreign 54,666 Domestic 111,040 Net 165,707	165,707	Foreign 0.42 Domestic 4.82 Net 5.24	Foreign 1.23 Domestic 2.50 Net 3.73	1.23 2.50 3.73
Alaska	9,711 -14,840 -5,130	9,130 -7,591 -1,539	1,539	1.77 -2.70 -0.93	1.46 -1.21 0.25	1.46 -1.21 0.25
Arizona	123,875 956,477 1,080,352	292,440 423,710 716,149	716,149	3.38 26.10 29.47	5.70 8.26 13.96	5.70 8.26 13.96
Arkansas	12,530 217,307 229,837	39,203 81,971 121,175	121,175	0.53 9.24 9.78	1.47 3.07 4.53	1.47 3.07 4.53
California	2,470,423 -1,821,377 649,045	1,939,185 -1,965,599 -26,414	-26,414	8.29 -6.11 2.18	5.73 -5.80 -0.08	5.73 -5.80 -0.08
Colorado	77,392 614,850 692,243	154,584 136,288 290,872	290,872	2.35 18.66 21.01	3.59 3.17 6.76	3.59 3.17 6.76
Connecticut	82,326 -128,933 -46,607	121,451 -92,519 28,932	28,932	2.50 -3.92 -1.42	3.57 -2.72 0.85	3.57 -2.72 0.85
Delaware	10,631 64,204 74,835	21,028 46,255 67,283	67,283	1.60 9.64 11.23	2.68 5.90 8.59	2.68 5.90 8.59
District of Columbia	32,540 -96,022 -63,483	25,723 -22,851 2,873	2,873	5.36 -15.82 -10.46	4.50 -3.99 0.50	4.50 -3.99 0.50
Florida	710,196 1,894,932 2,605,128	916,738 1,346,296 2,263,035	2,263,035	5.49 14.65 20.14	5.74 8.42 14.16	5.74 8.42 14.16
Georgia	126,846 1,004,907 1,131,753	302,500 393,074 695,575	695,575	1.96 15.51 17.47	3.69 4.80 8.50	3.69 4.80 8.50
Hawaii	58,312 -67,715 -9,402	42,074 5,437 47,511	47,511	5.26 -6.11 -0.85	3.47 0.45 3.92	3.47 0.45 3.92
Idaho	20,212 170,647 190,859	23,751 111,940 135,691	135,691	2.01 16.95 18.96	1.84 8.65 10.49	1.84 8.65 10.49
Illinois	425,051 -258,444 166,607	430,627 -880,248 -449,621	-449,621	3.72 -2.26 1.46	3.47 -7.09 -3.62	3.47 -7.09 -3.62
Indiana	35,467 180,196 215,662	100,168 -51,332 48,837	48,837	0.64 3.25 3.89	1.65 -0.84 0.80	1.65 -0.84 0.80
Iowa	24,607 25,259 49,867	38,692 -45,009 -6,317	-6,317	0.89 0.91 1.80	1.32 -1.54 -0.22	1.32 -1.54 -0.22
Kansas	32,763 35,036 67,798	56,138 -64,864 -8,726	-8,726	1.32 1.41 2.74	2.09 -2.41 -0.32	2.09 -2.41 -0.32
Kentucky	18,998 170,531 189,529	47,786 74,980 122,767	122,767	0.52 4.63 5.14	1.18 1.85 3.04	1.18 1.85 3.04
Louisiana	28,451 -67,297 -38,846	35,668 -224,845 -189,177	-189,177	0.67 -1.59 -0.92	0.80 -5.03 -4.23	0.80 -5.03 -4.23
Maine	4,503 11,155 15,658	8,704 30,690 39,394	39,394	0.17 0.91 1.28	0.68 2.41 3.09	0.68 2.41 3.09
Maryland	146,943 34,280 181,223	205,768 -76,806 128,961	128,961	3.07 0.72 3.79	3.88 -1.45 2.43	3.88 -1.45 2.43
Massachusetts	165,688 -124,215 41,473	263,435 -328,695 -65,260	-65,260	2.75 -2.06 0.69	4.15 -5.18 -1.03	4.15 -5.18 -1.03
Michigan	114,112 -31,842 82,270	180,082 -708,110 -528,027	-528,027	1.23 -0.34 0.89	1.81 -7.12 -5.31	1.81 -7.12 -5.31
Minnesota	63,660 193,091 256,750	113,817 -90,653 23,164	23,164	1.45 4.41 5.87	2.31 -1.84 0.47	2.31 -1.84 0.47
Mississippi	8,077 106,864 114,941	19,054 -61,106 -42,052	-42,052	0.31 4.15 4.46	0.67 -2.15 -1.48	0.67 -2.15 -1.48
Missouri	43,731 215,415 259,145	68,026 64,900 132,926	132,926	0.85 4.21 5.06	1.22 1.16 2.38	1.22 1.16 2.38
Montana	3,011 63,959 66,970	3,310 46,605 49,915	49,915	0.38 8.00 8.38	0.37 5.17 5.53	0.37 5.17 5.53
Nebraska	17,691 30,581 48,272	34,277 -40,540 -6,263	-6,263	1.12 1.94 3.06	2.00 -2.37 -0.37	2.00 -2.37 -0.37

Nevada	64,167	604,163	668,330	118,782	385,983	504,765	5.34	50.28	55.62	5.94	19.32	25.26
New Hampshire	8,354	56,080	64,434	19,689	10,658	30,347	0.75	5.06	5.81	1.59	0.86	2.46
New Jersey	414,113	-189,067	225,045	427,489	-492,878	-65,390	5.34	-2.44	2.90	5.08	-5.86	-0.78
New Mexico	42,051	108,486	150,537	50,942	35,235	86,177	2.78	7.16	9.94	2.80	1.94	4.74
New York	1,195,783	-1,303,173	-109,390	895,150	-1,570,310	-675,160	6.64	-7.24	-0.61	4.72	-8.27	-3.56
North Carolina	74,085	924,292	998,377	230,920	714,548	945,468	1.12	13.94	15.05	2.87	8.88	11.75
North Dakota	5,893	-28,561	-22,668	4,981	-2,274	2,707	0.92	-4.47	-3.55	0.78	-0.35	0.42
Ohio	61,412	-88,084	-26,673	129,215	-412,728	-283,513	0.57	-0.81	-0.25	1.14	-3.64	-2.50
Oklahoma	32,875	121,995	154,870	57,560	56,879	114,438	1.05	3.88	4.92	1.67	1.65	3.32
Oregon	74,645	348,243	422,888	101,814	128,821	230,635	2.63	12.25	14.88	2.98	3.77	6.74
Pennsylvania	127,779	-17,688	110,091	190,322	32,201	222,523	1.08	-0.15	0.93	1.55	0.26	1.81
Rhode Island	18,394	-11,551	6,842	32,325	-58,947	-26,622	1.83	-1.15	0.68	3.08	-5.62	-2.54
South Carolina	22,687	291,783	314,470	71,471	330,099	401,570	0.65	8.37	9.02	1.78	8.23	10.01
South Dakota	5,521	15,417	20,939	7,067	3,764	10,832	0.79	2.22	3.01	0.94	0.50	1.43
Tennessee	36,127	533,754	569,880	98,590	285,499	385,088	0.74	10.94	11.68	1.73	5.04	6.77
Texas	795,951	1,143,856	1,939,807	998,690	781,542	1,780,232	4.69	6.73	11.42	4.79	3.75	8.54
Utah	35,816	177,548	213,364	70,371	37,098	107,469	2.08	10.31	12.38	3.15	1.66	4.81
Vermont	5,609	16,970	22,579	5,308	-3,487	1,821	1.00	3.02	4.01	0.87	-0.57	0.30
Virginia	163,644	299,495	463,139	219,986	199,650	419,635	2.64	4.84	7.48	3.11	2.82	5.93
Washington	164,962	478,786	643,748	217,347	197,800	415,147	3.39	9.84	13.23	3.69	3.36	7.04
West Virginia	3,842	-2,955	887	6,040	39,059	45,099	0.21	-0.16	0.05	0.33	2.16	2.49
Wisconsin	29,697	200,239	229,936	75,399	-19,910	55,489	0.61	4.09	4.70	1.41	-0.37	1.03
Wyoming	2,257	8,831	11,089	3,559	33,802	37,360	0.50	1.95	2.44	0.72	6.85	7.57

Source: U.S. Bureau of the Census, RLS Demographics

Chart 6: Net Domestic Migration Rates in the 2000s



Southern and Western states—led by Nevada, the Carolinas, Idaho, Arizona and Florida—had the top domestic and net migration rates in the 2000s. California was the exception to this regional trend.

Source: U.S. Bureau of the Census

also the one with its population centers nearest those of California: Las Vegas and Reno are, respectively, just a half-day's drive from Los Angeles or San Francisco. Arizona is another fast-growing destination state in the California neighborhood.

PART I: WHERE CALIFORNIANS ARE MOVING: IRS DATA

When Californians leave, where do they go? The answer helps point us toward the all-important issue of why people are leaving—and what this says about the state's future.

To identify favored "target states" for out-migration, the most useful tool is the annual data from the Internal Revenue Service showing how many filers of income-tax returns have moved between two years. Our analysis of these data reveals in some detail the starting points and destinations of those who have left California. It also allows us to make some reasonable inferences about their motives.

This IRS information is not a perfect tool. It leaves out students, low-income persons, the elderly, and others who may not file income-tax returns, and it does not track moves associated with first-time or final filings. For these reasons, it does not produce as high a total for net migration from California as the Census figures do. But the IRS records show migration between specific states, metropolitan areas, and counties (see Appendix). In this study, we have taken advantage of this feature of the data to map the California exodus in detail.

We analyzed IRS migration data on year-to-year periods starting with 2000–01 and ending with 2009–10 (ten years in all). We looked first at migration between California and other states, to see which states are most popular as destinations for Californians and which states continue to send a significant number of residents to the Golden State. Second, we took a finer-grained look at population movements in different regions of the state, to examine more precisely where inside California the migrants came from.

A. Migration from and to California

The IRS data show a pattern of movement over the past decade from California mainly to states in the western and southern United States. Texas, Nevada, and Arizona, in that order, are the top magnet states on the basis of the net migration (measured by tax exemptions) that they drew from California between 2000 to 2010. Oregon, Washington, Colorado, Idaho, and Utah follow. Rounding out the top ten are two southern states, Georgia and South Carolina. On the other hand, the top ten sender states—those that lost more residents to California than they gained—are all in the Northeast or Midwest. New York, Illinois, and New Jersey are the largest in this category, though their deficits with California are far smaller than California's deficits with its leading destination states.

The IRS data also put a dollar figure on migration patterns. Along with totals for the number of individuals moving between states, the IRS adds up the income reported in the tax returns of migrants. The agency's data reveal just how much wealth California is losing as a result of its people's exodus. This is not only a measure of economic damage but also of political and fiscal consequences because the state government depends heavily on personal income tax for its revenue.

The data show aggregate income moving into and out of California in roughly the same pattern that people do. There are some differences because some migrants are wealthier than others, so the movement of dollars does not precisely track that of individuals. For example, while Texas took in the largest number of former Californians between 2000 and 2010, it was Nevada that received the largest share of formerly Californian income: some \$5.67 billion in income shifted from California to the Silver State during that decade. Arizona had the next biggest gain at California's expense, at \$4.96 billion, followed by Texas, at \$4.07 billion, and Oregon close behind, at \$3.85 billion. The lower ranking for Texas is due to Californians moving to Texas having lower annual income per capita (\$23,150) than did Texans going to California (\$26,640). In the

Table 3: Net Migration Between California and Other States, 2000–10

	2000- 2001	2001- 2002	2002- 2003	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2008- 2009	2009- 2010	Total 2000-2010	Rank
ALABAMA	-411	-515	-815	-924	-1,652	-1,543	-1,275	-920	-1,064	-642	-9,761	21
ALASKA	34	-326	63	-95	-307	-86	-17	-236	-739	-678	-2,387	32
ARIZONA	-9,866	-15,156	-15,616	-24,620	-45,265	-49,026	-31,408	-15,533	-3,821	-1,622	-211,933	2
ARKANSAS	-1,333	-1,756	-1,800	-2,237	-3,613	-4,332	-3,446	-2,519	-1,485	-1,309	-23,830	16
COLORADO	-5,555	-4,834	-1,498	-2,284	-7,192	-10,661	-11,297	-7,991	-6,431	-4,379	-62,122	6
CONNECTICUT	914	50	-115	520	515	871	742	878	626	687	5,688	43
DELAWARE	106	-87	-192	-67	-135	46	-9	171	46	50	-71	38
DISTRICT OF COLUMBIA	279	46	-125	-222	-154	15	-25	71	-289	-582	-986	34
FLORIDA	-2,178	-6,133	-6,223	-7,965	-9,769	-5,762	-1,928	2,079	2,653	451	-34,775	11
GEORGIA	-2,349	-3,318	-2,694	-3,989	-6,346	-8,572	-7,467	-2,847	-1,505	-487	-39,574	9
HAWAII	949	-550	-1,077	-1,452	-2,065	-1,646	-21	-45	610	-221	-5,518	27
IDAHO	-2,324	-3,186	-3,303	-5,353	-9,003	-11,906	-8,830	-5,192	-2,947	-2,230	-54,274	7
ILLINOIS	5,939	3,219	2,927	2,744	1,287	1,415	1,172	2,298	2,177	2,803	25,981	49
INDIANA	96	-280	-682	-325	-1,347	-1,879	-1,369	-434	-128	79	-6,269	26
IOWA	-131	-532	-611	-881	-864	-1,000	-818	-611	-1,251	-539	-7,238	24
KANSAS	50	-336	-691	-618	-1,010	-1,484	-1,659	-926	-954	-942	-8,570	22
KENTUCKY	38	-651	-589	-764	-1,266	-1,322	-1,138	-712	-402	-526	-7,332	23
LOUISIANA	599	-323	-114	-403	-649	2,662	-982	-1,145	-1,173	-1,382	-2,910	30
MAINE	-62	-238	-196	-321	-274	-49	-20	55	216	75	-814	35
MARYLAND	201	-1,202	-863	-616	-659	135	308	703	-26	-833	-2,852	31
MASSACHUSETTS	2,446	1,212	1,251	2,404	2,663	3,062	2,846	2,498	1,325	1,443	21,150	47
MICHIGAN	2,237	863	282	1,418	1,237	2,226	2,931	4,218	2,818	2,396	20,626	46
MINNESOTA	73	-76	-401	-433	-294	-66	55	508	764	695	2,493	41
MISSISSIPPI	-1	-65	-248	-431	-502	115	-860	-455	49	122	-2,276	33
MISSOURI	-712	-1,427	-1,770	-2,219	-3,722	-3,649	-3,260	-1,119	-742	-612	-19,232	18
MONTANA	-560	-696	-1,077	-1,652	-2,137	-2,237	-1,647	-1,350	-933	-600	-12,889	19
NEBRASKA	-359	-575	-737	-557	-484	-608	-1,077	-704	-1,010	-859	-6,970	25
NEVADA	-20,369	-21,971	-20,296	-30,374	-31,610	-30,925	-24,743	-12,094	-3,918	-2,031	-198,331	3
NEW HAMPSHIRE	-73	-214	-14	77	133	74	190	99	164	154	590	40
NEW JERSEY	4,353	924	980	2,193	2,762	3,041	2,557	2,988	1,907	1,151	22,856	48
NEW MEXICO	-181	-1,490	-1,348	-2,179	-3,472	-5,052	-5,369	-2,846	-2,501	-1,581	-26,019	14
NEW YORK	5,873	3,437	2,171	2,641	3,842	3,779	3,467	3,303	817	2,104	31,434	50
NORTH CAROLINA	-1,907	-2,560	-2,531	-3,433	-5,138	-6,965	-6,893	-4,659	-2,770	-1,782	-38,638	10
NORTH DAKOTA	236	13	3	-267	11	-114	-92	-98	-129	-149	-586	36
OHIO	2,741	423	456	828	462	706	1,921	1,119	731	1,150	10,537	45
OKLAHOMA	-775	-2,120	-1,063	-1,775	-2,931	-4,371	-4,168	-2,788	-3,121	-2,152	-25,264	15
OREGON	-7,254	-10,973	-9,963	-11,072	-18,159	-21,667	-16,549	-12,577	-7,560	-5,708	-121,482	4
PENNSYLVANIA	2,661	-186	-166	375	533	1,214	1,051	1,886	1,060	529	8,957	44
RHODE ISLAND	-89	-282	-377	-158	-2	74	94	155	174	101	-310	37
SOUTH CAROLINA	-183	-1,056	-961	-1,345	-1,431	-1,788	-1,885	-1,093	-679	-500	-10,921	20

SOUTH DAKOTA	-51	-183	-107	-345	-230	-405	-410	-429	-439	-408	-3,008	29
TENNESSEE	-1,051	-1,713	-1,921	-2,678	-4,152	-4,535	-5,637	-2,639	-2,281	-867	-27,474	13
TEXAS	-6,462	-12,672	-8,865	-11,990	-23,270	-41,164	-50,647	-32,406	-22,672	-14,963	-225,111	1
UTAH	-464	-1,046	-579	-2,914	-6,671	-9,709	-11,362	-8,327	-3,304	-1,258	-45,634	8
VERMONT	17	-190	-119	-39	-32	12	128	109	24	70	-20	39
VIRGINIA	-1,133	-1,959	-3,757	-3,675	-3,365	-3,209	-2,240	-520	-1,776	-823	-22,457	17
WASHINGTON	-2,547	-4,987	-2,470	-7,554	-14,211	-16,986	-13,099	-11,890	-10,234	-4,741	-88,719	5
WEST VIRGINIA	90	0	-213	-15	-153	-263	-152	-59	-19	-93	-5,020	28
WISCONSIN	-51	-4,143	-303	-75	-442	-354	67	399	58	574	-2,602	42
WYOMING	-48	2,729	-328	-514	-617	-756	-747	-820	-982	-255	-31,718	12

Source: Internal Revenue Service, RLS Demographics

Table 4: Components of Migration Between California and Other States

	EXEMPTIONS			AGGREGATE INCOME (\$ THOUSANDS)			INCOME PER EXEMPTION (\$ THOUSANDS)	
	In-Flows	Out-Flows	Net Flows	In-Flows	Out-Flows	Net Flows	In-Flows	Out-Flows
ALABAMA	24,950	34,711	-9,761	513,933	718,913	-204,980	20.60	20.71
ALASKA	24,350	26,737	-2,387	475,444	509,296	-33,852	19.53	19.05
ARIZONA	259,470	471,403	-211,933	5,807,252	10,768,757	-4,961,505	22.38	22.84
ARKANSAS	26,015	49,845	-23,830	429,338	807,013	-377,675	16.50	16.19
COLORADO	143,817	205,939	-62,122	3,935,057	5,936,667	-2,001,610	27.36	28.83
CONNECTICUT	38,117	32,429	5,688	1,778,757	1,488,856	289,901	46.67	45.91
DELAWARE	6,706	6,777	-71	209,526	200,230	9,296	31.24	29.55
DISTRICT OF COLUMBIA	15,025	16,011	-986	766,330	701,395	64,935	51.00	43.81
FLORIDA	184,202	218,977	-34,775	5,050,373	6,533,763	-1,483,390	27.42	29.84
GEORGIA	92,320	131,894	-39,574	2,426,852	3,137,118	-710,266	26.29	23.79
HAWAII	88,869	94,387	-5,518	1,928,117	2,607,823	-679,706	21.70	27.63
IDAHO	41,721	95,995	-54,274	813,310	2,125,830	-1,312,520	19.49	22.15
ILLINOIS	160,842	134,861	25,981	5,746,470	4,103,982	1,642,488	35.73	30.43
INDIANA	49,509	55,778	-6,269	1,218,602	1,238,580	-19,978	24.61	22.21
IOWA	27,444	34,682	-7,238	577,904	687,961	-110,057	21.06	19.84
KANSAS	37,482	46,052	-8,570	851,645	871,057	-19,412	22.72	18.91
KENTUCKY	24,360	31,692	-7,332	548,229	677,174	-128,945	22.51	21.37
LOUISIANA	38,898	41,808	-2,910	777,780	807,858	-30,078	20.00	19.32
MAINE	11,127	11,941	-814	253,857	338,684	-84,827	22.81	28.36
MARYLAND	64,829	67,681	-2,852	2,172,073	2,068,440	103,633	33.50	30.56
MASSACHUSETTS	95,953	74,803	21,150	4,126,792	3,164,224	962,568	43.01	42.30
MICHIGAN	87,580	66,954	20,626	2,609,397	1,752,120	857,277	29.79	26.17
MINNESOTA	56,787	54,294	2,493	1,844,074	1,628,425	215,649	32.47	29.99
MISSISSIPPI	21,129	23,405	-2,276	384,040	419,810	-35,770	18.18	17.94
MISSOURI	58,568	77,800	-19,232	1,519,984	1,775,264	-255,280	25.95	22.82
MONTANA	20,814	33,703	-12,889	404,992	898,224	-493,232	19.46	26.65
NEBRASKA	23,826	30,796	-6,970	487,185	560,792	-73,607	20.45	18.21

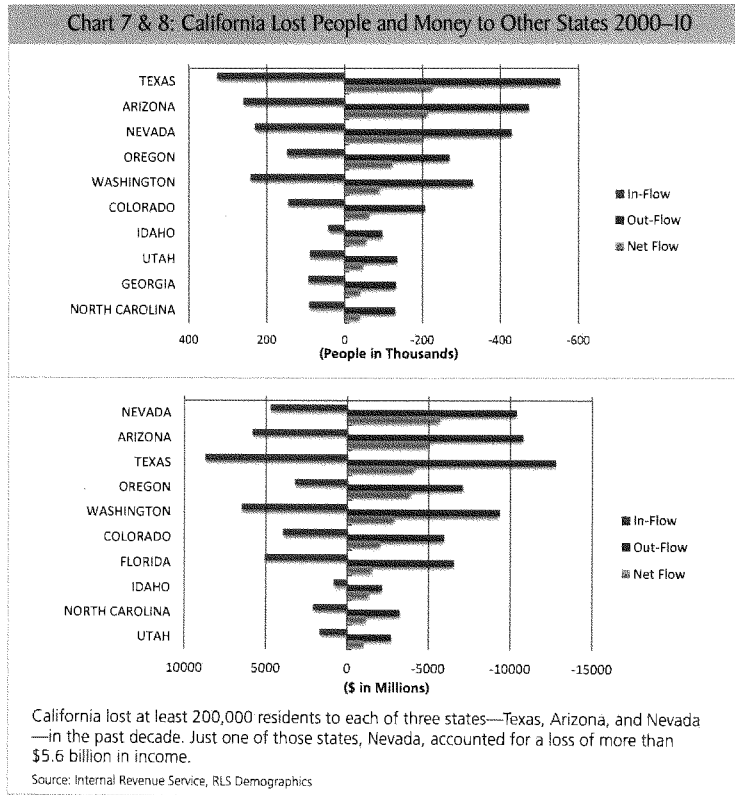
NEVADA	229,655	427,986	-198,331	4,704,122	10,377,646	-5,673,524	20.48	24.25
NEW HAMPSHIRE	14,099	13,509	590	481,835	471,410	10,425	34.18	34.90
NEW JERSEY	89,960	67,104	22,856	3,908,818	2,724,187	1,184,631	43.45	40.60
NEW MEXICO	44,868	70,887	-26,019	997,179	1,658,934	-661,755	22.22	23.40
NEW YORK	195,308	163,874	31,434	8,651,810	6,810,804	1,841,006	44.30	41.56
NORTH CAROLINA	90,844	129,482	-38,638	2,072,621	3,193,868	-1,121,247	22.82	24.67
NORTH DAKOTA	7,348	7,934	-586	141,057	153,159	-12,102	19.20	19.30
OHIO	84,156	73,619	10,537	2,636,982	1,980,870	656,112	31.33	26.91
OKLAHOMA	42,653	67,917	-25,264	751,115	1,093,742	-342,627	17.61	16.10
OREGON	147,263	268,745	-121,482	3,214,047	7,059,232	-3,845,185	21.83	26.27
PENNSYLVANIA	84,696	75,739	8,957	2,963,080	2,494,833	468,247	34.98	32.94
RHODE ISLAND	12,022	12,332	-310	334,823	338,936	-4,113	27.85	27.48
SOUTH CAROLINA	29,941	40,862	-10,921	664,099	969,865	-305,766	22.18	23.74
SOUTH DAKOTA	9,050	12,058	-3,008	202,353	280,915	-78,562	22.36	23.30
TENNESSEE	44,467	71,941	-27,474	1,030,113	1,786,950	-756,837	23.17	24.84
TEXAS	326,803	551,914	-225,111	8,705,983	12,774,074	-4,068,091	26.64	23.15
UTAH	88,467	134,101	-45,634	1,675,164	2,689,001	-1,013,837	18.94	20.05
VERMONT	6,647	6,667	-20	172,105	203,978	-31,873	25.89	30.60
VIRGINIA	129,177	151,634	-22,457	3,811,718	4,284,238	-472,520	29.51	28.25
WASHINGTON	240,659	329,378	-88,719	6,473,300	9,345,337	-2,872,037	26.90	28.37
WEST VIRGINIA	5,985	11,005	-5,020	127,453	239,681	-112,228	21.30	21.78
WISCONSIN	44,370	41,768	2,602	1,245,362	1,025,621	219,741	28.07	24.56
WYOMING	11,102	42,820	-31,718	227,833	1,154,279	-926,446	20.52	26.96
TOTALS	3,704,250	4,944,631	-1,240,381	102,850,285	129,639,816	-26,789,531	27.77	26.22
Components of Migration Between California and Other States—In-Flows, Out-Flows and Net Flows for Exemptions (Individuals) and Aggregate Income, 2000–10								
Source: Internal Revenue Service, RLS Demographics								

other three states, that income difference is either much narrower or tilted the other way. Inbound and outbound incomes were less than \$500 apart in Arizona. In Oregon and Nevada, newcomers from California had incomes about \$4,000 higher than those going the opposite way.

The best explanation for these patterns is that relatively affluent retirees (or owners of vacation homes) move from California to Oregon and Nevada, while Texas gets more young families looking for economic opportunity. Arizona has a mix of both types of ex-California migrant. Another type of IRS data, exemptions per return, supports this explanation. Returns of Californians bound for Texas average 2.21 exemptions, compared with 1.89 for those who went to Oregon, 1.98 for Nevada, and 2.07 for Arizona.

The ratios for returns of those moving to California were uniformly lower, ranging from 1.75 for those coming from Oregon to 1.88 for people leaving Texas. Those heading to the Golden State, in other words, tend to have fewer children than those who are leaving, or no children at all, or are singles.

Family needs are not the only influence on decisions that ex-Californians make about where to go. The data also show that simple proximity has an important role. Over the period we studied, the three states adjoining California—Arizona, Nevada, and Oregon—received nearly 24 percent of its migrants (a total of 1,168,134). Migrants to the next tier of states—Washington, Idaho, Utah, and New Mexico—brought the total to 1,798,496, or nearly 36 percent of those who left California for any other



part of the United States. Inflows from these seven states totaled 992,093, for a net out-migration of 806,403. So about 65 percent of California's overall migration deficit involves nearby states.

How much of this movement was related to jobs, and how much to other factors? The IRS does not ask people why they are moving (nor, we suspect, would most citizens wish it to). So we must extrapolate to find a reason that smaller states such as Arizona and,

especially, Nevada have grown so much at California's expense. Retirement may be part of the explanation. Arizona and Nevada are logical nearby retirement destinations, and more Californians are likely to be familiar with them than with more distant retirement meccas such as Florida. Nevada is especially near and has the lower tax burden of the two. Lower taxes, lower costs, and proximity to old haunts can create a powerful incentive. For example, a Bay Area resident who moves to the Reno area will pay lower sales taxes and

Table 5: Out-Flows from California by Region, 2000-10

Destination State	Total Out-Flows (Exemptions)	Central-North	Central-South	East Bay Area	LA-Orange Counties	Mid-Coastal	North Country	Riverside-San Bern. Counties	Sacramento	San Diego Area	Santa Clara Area	San Francisco Area	Wine Country
Alabama	12,392	109	40	550	6,031	203		1,510	297	3,309	291	52	
Alaska	13,712	1,320	1,177	585	3,248	754	73	2,075	1,346	2,362	388	234	150
Arizona	449,927	21,975	17,308	21,379	154,123	36,033	3,908	75,816	11,033	74,667	18,466	10,167	5,052
Arkansas	20,202	368	398	405	11,252	1,618		2,807	537	2,635	182		
Colorado	166,514	5,133	5,560	10,872	60,805	13,927	516	20,310	5,076	24,710	10,946	7,303	1,356
Connecticut	24,467			2,781	9,613	706		1,231	193	5,181	1,892	2,849	21
Delaware	3,547	245		385	1,500			81	77	799	365	91	
District of Columbia	14,991	187	42	1,812	4,961	917		618	482	2,184	903	2,771	114
Florida	165,649	2,379	3,637	10,345	62,704	7,814		16,421	4,483	41,170	8,140	7,805	751
Georgia	85,236	1,164	981	6,675	39,652	3,484		9,907	2,936	13,162	4,106	3,112	57
Hawaii	88,384	4,832	2,407	6,246	22,442	9,681	712	8,250	2,789	18,856	4,178	6,260	1,731
Idaho	59,273	5,526	2,421	3,665	16,292	4,169	1,275	8,995	3,731	7,977	2,952	881	1,389
Illinois	101,364	2,920	1,965	7,906	38,889	4,862	31	8,293	1,897	19,637	6,459	8,300	405
Indiana	25,360	180	234	1,073	12,535	234		3,076	645	5,567	1,295	521	
Iowa	11,572		164	671	6,072	25		862	172	2,593	864	149	
Kansas	23,515	224	410	1,077	10,955	719		4,236	656	4,215	755	237	31
Kentucky	11,185		51	537	4,715	52		2,483	345	2,512	308	182	
Louisiana	18,304	45	33	1,374	8,104	161		1,964	424	5,196	374	629	
Maine	3,800			258	1,183	45		80		1,730	180	324	
Maryland	50,983	574	1,025	4,235	17,000	4,255		3,522	1,073	12,860	3,360	2,976	103
Massachusetts	62,254	559	185	7,012	21,395	2,025		2,339	993	10,718	6,619	10,083	326
Michigan	37,711	112	357	3,089	16,191	697		3,481	597	8,747	2,550	1,890	
Minnesota	30,251	164	1,429	2,327	11,830	814		2,154	1,365	5,862	2,081	1,968	257
Mississippi	6,770	364	50		2,311	384		437	148	3,076			
Missouri	36,016	201	228	2,057	14,436	778		5,618	1,621	8,571	1,308	1,198	
Montana	12,228	46	18	322	4,120	1,419	12	1,874	496	3,253	377	138	153
Nebraska	15,393	220	312	681	7,076	1,581		1,791	372	2,732	500	128	
Nevada	407,669	40,917	17,445	26,240	151,395	25,157	8,456	49,450	13,462	38,184	18,206	13,828	4,929
New Hampshire	6,332			387	2,493	55		289	23	1,882	752	451	

New Jersey	49,124	436	5,141	22,128	370	1,006	459	9,507	5,981	4,096
New Mexico	47,513	1,047	1,381	2,701	18,020	2,892	67	7,464	1,198	8,629
New York	129,407	794	432	11,028	57,258	2,868	12	5,916	1,640	17,544
North Carolina	83,160	1,294	1,359	4,928	28,601	3,267	41	12,483	2,407	20,120
North Dakota	1,842	67			393	948	28	406		
Ohio	39,537	480	607	2,653	17,479	735		3,586	1,038	9,311
Oklahoma	30,694	1,163	1,997	1,270	11,571	975		5,543	1,458	5,644
Oregon	216,694	15,591	7,859	19,222	52,098	16,849	15,313	19,184	11,907	22,786
Pennsylvania	43,469		37	3,709	18,150	743		2,309	557	10,712
Rhode Island	8,277		118	351	2,137	1,190		315	86	3,391
South Carolina	20,351	123	428	237	7,287	171		3,122	428	8,087
South Dakota	2,902	21	21	23	1,283	30		620	879	25
Tennessee	37,624	142	378	1,832	17,424	1,287		5,563	1,184	7,692
Texas	447,606	19,139	16,651	27,859	171,457	25,019	290	62,162	12,773	70,020
Utah	111,268	6,408	4,865	6,257	41,413	7,465	621	18,270	5,150	12,885
Vermont	1,453			112	486			466	166	223
Virginia	106,926	1,126	3,041	5,407	29,332	9,576		8,904	1,993	38,625
Washington	274,059	16,846	13,107	22,280	77,465	17,731	4,326	29,174	13,017	43,066
West Virginia	159				113			46		
Wisconsin	19,294	98	445	1,578	7,617	209		1,400	569	5,103
Wyoming	3,693	26	119		1,152	1,038		391	42	925
Total	3,640,053	154,565	110,722	241,534	1,306,187	215,732	35,653	427,410	113,175	630,191
Regional Population (2000)	2,619,927	2,107,547	2,402,443	12,397,876	2,017,858	956,154	3,276,461	1,230,501	2,971,525	1,687,415
Out-Flow Rate (Statewide=10.71%)		5.90%	5.25%	10.05%	10.54%	10.69%	3.73%	13.04%	9.20%	21.21%
										11.91%
										9.83%
										5.71%

Source: Internal Revenue Service, BLS Demographics

Table 6: Net Migration to and from California by Region, 2000-10

Destination State	Total Net Migration (Exemptions)	Central-North	Central-South	East Bay Area	LA-Orange Counties	Mid-Coastal	North County	Riverside-San Bernardino Counties	Sacramento	San Diego Area	Santa Clara County	San Francisco Area	Wine Country
Alabama	-4,913	-16	-40	-145	-2,517	-154	0	-903	-111	-1,143	57	59	0
Alaska	-2,879	-126	-294	-128	-717	-145	56	-257	-632	-480	-63	17	-110
Arizona	-230,553	-10,710	-5,391	-11,760	-91,779	-20,109	-1,561	-37,843	-4,194	-30,551	-10,177	-3,746	-2,732
Arkansas	-14,041	-247	-357	-297	-7,943	-1,588	0	-1,898	-335	-1,346	-66	36	0
Colorado	-67,630	-2,088	-1,728	-4,354	-28,925	-6,292	-275	-8,014	-1,355	-7,169	-5,079	-2,002	-349
Connecticut	2,982	0	0	-134	474	216	0	264	355	1,177	329	194	107
Delaware	-63	-119	0	-67	-26	-40	0	30	26	35	-24	52	0
District of Columbia	-2,276	-78	-42	-381	-733	-347	0	-149	-150	-295	-66	46	-81
Florida	-40,165	-428	-841	-3,418	-16,127	-2,253	0	-4,858	-1,342	-7,102	-2,189	-1,671	64
Georgia	-35,119	-795	-713	-2,757	-18,012	-2,335	0	-4,353	-1,250	-4,058	-844	-14	12
Hawaii	-13,719	-764	-5	-1,222	-4,310	-3,200	-206	-922	-184	-355	-481	-1,544	-526
Idaho	-43,433	-4,702	-1,877	-2,784	-11,937	-3,446	-1,119	-6,651	-2,659	-4,814	-1,772	-498	-1,174
Illinois	16,585	257	169	1,669	5,398	82	44	1,346	645	2,457	2,411	1,560	447
Indiana	-4,108	-155	-131	200	-3,539	233	0	-670	-264	-547	387	364	14
Iowa	-3,468	0	-107	-236	-2,260	4	0	-452	-35	-427	-99	144	0
Kansas	-6,898	-39	-188	-185	-4,263	-452	0	-1,566	-71	-803	378	322	-31
Kentucky	-2,418	0	-51	-120	-1,055	59	0	-599	-91	-744	150	33	0
Louisiana	-1,724	60	48	350	-1,330	72	0	-425	100	-1,022	334	89	0
Maine	47	0	0	-7	-185	-26	0	40	21	289	-48	-37	0
Maryland	-6,461	-15	-301	-638	-1,727	-2,286	0	-185	-98	-1,198	-29	50	-34
Massachusetts	12,365	265	79	694	4,269	210	0	641	367	2,177	1,362	2,200	111
Michigan	15,129	237	66	1,275	4,690	827	0	1,184	1,020	2,507	1,670	1,533	120
Minnesota	1,796	129	-223	334	-181	173	0	208	-63	577	399	415	28
Mississippi	-727	313	465	18	-1,111	-227	0	-54	-62	-129	60	0	0
Missouri	-8,823	-29	-65	-153	-3,691	-133	0	-2,593	-746	-2,119	219	471	16
Montana	-6,816	-46	30	-174	-2,393	-472	8	-1,394	-327	-1,628	-257	-10	-153
Nebraska	-5,403	75	-206	-90	-3,155	-1,203	0	-677	157	-499	25	155	15
Nevada	-215,089	-20,483	-5,582	-16,765	-93,263	-14,253	-2,616	-19,468	-3,612	-15,900	-12,219	-8,287	-2,641
New Hampshire	246	0	0	37	167	-25	0	-12	13	124	-3	-55	0

New Jersey	15,240	-40	0	1,454	5,692	737	0	2,309	344	1,758	1,621	1,288	77
New Mexico	-24,107	-437	-520	-1,300	-10,295	-1,671	-67	-4,355	-390	-3,252	-1,048	-619	-153
New York	14,741	-175	161	563	8,572	-80	-12	1,754	913	2,499	1,690	-1,103	-41
North Carolina	-33,582	-842	-179	-2,422	-14,232	-842	-41	-5,158	-1,175	-5,512	-2,000	-868	-311
North Dakota	-410	-67	46	0	65	-337	0	-28	0	-89	0	0	0
Ohio	7,049	-207	-6	467	3,281	241	0	339	309	493	1,052	1,031	49
Oklahoma	-12,644	-454	-933	-526	-5,477	-197	0	-2,634	-575	-1,811	-139	114	-12
Oregon	-122,690	-9,967	-4,286	-12,045	-29,572	-11,614	-8,370	-8,968	-5,365	-9,793	-9,938	-7,565	-5,207
Pennsylvania	5,530	67	44	206	1,769	351	0	-72	284	556	1,396	870	59
Rhode Island	-1,252	0	-118	24	154	-1,190	0	0	29	-241	-10	100	0
South Carolina	-8,042	97	-288	-53	-3,480	-79	0	-1,719	-395	-2,163	38	0	0
South Dakota	-1,415	-21	-21	-23	-645	-30	0	-296	45	-411	-13	0	0
Tennessee	-16,740	-100	-125	-671	-8,966	-472	0	-2,671	-433	-2,995	-233	-33	-41
Texas	-221,509	-10,172	-7,727	-11,181	-96,306	-14,616	-186	-35,099	-6,034	-24,671	-10,956	-3,038	-1,523
Utah	-47,858	-2,760	-1,891	-2,125	-20,546	-3,758	-173	-9,247	-1,706	-3,767	-1,412	-38	-435
Vermont	133	0	0	60	62	0	0	0	0	-45	27	29	0
Virginia	-24,315	-568	3	-1,445	-7,480	-4,184	0	-2,135	-632	-6,994	-796	-10	-74
Washington	-96,150	-6,115	-4,442	-9,349	-30,825	-5,836	-1,472	-8,068	-4,339	-10,760	-7,857	-5,086	-2,001
West Virginia	205	0	0	16	56	0	0	0	0	62	35	36	0
Wisconsin	124	-8	-109	-17	-645	26	0	97	76	57	365	300	-18
Wyoming	-1,785	-26	-101	0	-751	-386	0	-250	-42	-278	0	49	0
Total	-1,237,053	-71,299	-37,777	-79,605	-495,750	-100,967	-15,990	-166,441	-33,973	-140,343	-53,813	-24,567	-16,528
Net Mig. Rate (Statewide=3.64%)	-2.72%	-1.79%	-3.31%	-4.00%	-5.00%	-5.00%	-1.67%	-5.08%	-2.76%	-4.72%	-3.19%	-1.42%	-2.82%

Source: Internal Revenue Service, RLS Demographics

no state income tax at all, while still living less than four hours by car from San Francisco. Las Vegas is almost as convenient to Los Angeles—less than a five-hour drive. Arizona, another low-tax state, also has popular retirement destinations. Oregon's attractive retirement options are farther from California's main population centers, and Oregon's income-tax burden is similar to California's. These factors may help explain the greater pull of Arizona and Nevada. (Then too, a Californian could perceive that their second residence could have implications for their tax bill and consider their address in another state as their principal residence. The real effect of this is impossible to know but it may be a factor especially in the Nevada region around Lake Tahoe, which is even closer to San Francisco than Reno.)

B. Migration from the "Californias"

California is a huge, diverse state, divided along a number of real and figurative fault lines. Coastal and inland regions differ in their politics and economic foundations. The North has historically been at odds with the South over political power and water. California is the most urbanized state in the nation, yet it has vast rural regions and deserts that are remote from its cities in attitude as well as distance. So generalizing about migration from California as a whole won't reveal much about the motives of those who choose to leave. For this study, therefore, we have grouped the state's counties into 12 distinct "Californias" to give a clearer picture of the exodus. These regions, from south to north, are:

- San Diego Area: San Diego and Imperial Counties
- Los Angeles and Orange Counties
- San Bernardino and Riverside Counties
- Mid-coastal: the coastal region from Ventura to Santa Cruz County, including San Benito County
- Central-South: the San Joaquin Valley from Kern County in the South to Madera County in the north, including Inyo County east of the Sierra Nevada
- Santa Clara County, including San Jose and the heart of Silicon Valley
- San Francisco Area: the city/county of San Francisco with Marin and San Mateo Counties
- East Bay: Alameda and Contra Costa Counties

- Central-North: the Central Valley and Mother Lode from Merced County in the South to Yuba, Sierra, and Colusa Counties in the North; excludes Sacramento County
- Sacramento County
- Wine Country: Napa and Sonoma Counties
- North Country: coastal regions from Mendocino County northward to the Oregon border; northern Sacramento Valley eastward to the Nevada border

The 2000–10 IRS data for these regions show, again, the effect of proximity: Oregon is the most popular destination for those leaving the North Country, as is Nevada for the adjacent Central-North region. The data also reveal patterns of migration within California. For example, San Bernardino and Riverside Counties have seen heavy in-migration in recent years, much of it people leaving the congested Los Angeles–Orange County coastal region. But that movement away from the coast doesn't stop at the state line. San Bernardino and Riverside Counties have also been a source of considerable migration to points outside California: 13.04 percent of their 2000 population left the state in the 2000s. This was greater than the statewide average out-migration of 10.71 percent. When in-migration from other states is taken into account, the two counties still had net out-migration of 5.08 percent, the highest in California and well above the state average of 3.64 percent. Likewise, the San Diego area was a major source of out-migration, with an outflow rate of 21.21 percent and a net out-migration rate of 4.72 percent. For both these California regions, Texas and Arizona were the leading destinations for migrants. Los Angeles and Orange Counties also accounted for a large share of the state's exodus.

This means that the main current of migration out of California in the past decade has flowed eastward across the Colorado River, reversing the storied passages of the Dust Bowl era. The three regions that make up Southern California—Los Angeles/Orange, Riverside/San Bernardino, and San Diego—had about 55 percent of the state's population in 2000 but accounted for about 65 percent of the net out-migration in the decade that followed. More than

70 percent of the state's net migration to Texas came from these areas; 69 percent of migration to Arizona and 60 percent of the net flow to Nevada was from Southern California.

In contrast, regions to the north were more stable. San Francisco, East Bay, and Santa Clara County had net out-migration rates of 1.42 percent, 3.31 percent, and 3.19 percent, respectively, all below the state average. Nevada received the highest net migration from all three areas, but northern migrants' destinations were more diverse than other Californians'. Washington was the most popular destination state for those leaving San Francisco and its suburbs, while Texas led as a target from the East Bay and Santa Clara County. People in the coastal and interior regions of Northern California were also more inclined than Southern Californians to stay put. In the North Country region, the net migration rate was 1.67 percent, and more than half this flow went to neighboring Oregon. In the mid-state and Sierra Nevada regions (Central-North, Central-South, Sacramento, and the Wine Country), all counties had net migration rates below the state average. The only region outside Southern California with above-average net migration was the mid-coastal area, which at its southern end includes the Los Angeles suburbs in Ventura County.

PART II: WHY CALIFORNIANS ARE MOVING: ANALYZING THE DATA

People pull up stakes for many reasons, from jobs to family ties to climate. It is impossible to know for certain what motivates any individual decision to leave the state. But millions of individual decisions do form broad social patterns that are clearly related to economic changes. More often than not, people move because there is a better opportunity elsewhere. For an individual, the motivator is often a job. For a company, it is a chance to set up shop where conditions are more conducive to making a profit. The target could be a place with lower taxes and fees, friendlier regulation, better access to markets, or a labor pool with the right skills at the right price. Even retirees' moves can be indirectly tied to jobs, as when

they migrate to be near children who have taken jobs in another state. The push and pull of individual decisions will cause large-scale trends and patterns whose causes and consequences can be analyzed.

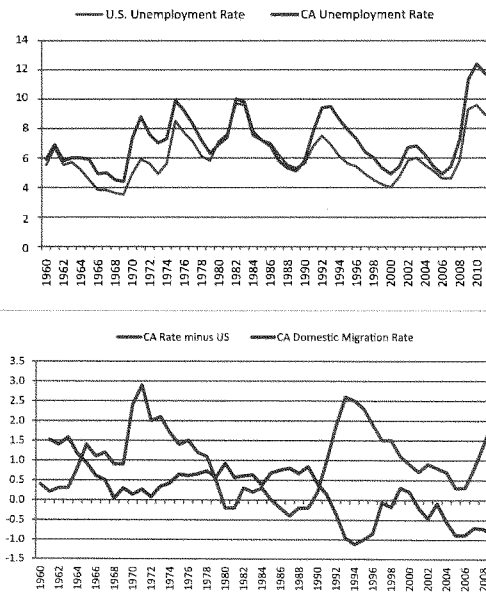
A. ECONOMIC ADVERSITY

In this study, we have engaged in such an analysis to identify the economic and political triggers of the California exodus that began about two decades ago. Clearly, something happened around that time to change California from a "pull" to a "push" state. What was it? There is no simple answer to that question. But we do know that several trends converged around that time to sap the state's economic vitality.

One was the recession of 1990. The state's unemployment rate, which had tracked the U.S. rate closely through most of the 1980s, surpassed the national average after 1990. By 1993, in fact, the California rate was 2.6 percentage points above the country's overall rate. Whenever California's unemployment is higher than the U.S. rate, migration into the state tends to fall and out-migration rises. In most years since 1960, California's unemployment rate has been above the national average. When that gap narrows or closes (and in the few cases when California actually has a lower jobless rate), in-migration has been high. In contrast, when the gap opens, out-migration soars.

The early 1990s were the most dramatic demonstration we know of this effect. In those years, California had a sharp and prolonged recession while the rest of the nation was going through a relatively mild and brief downturn. The state's hard fall was due in part to its dependence on the defense sector, which had thrived during the Reagan-era arms buildup of the 1980s, and then shriveled with the end of the Cold War. In 1995, the state's Legislative Analyst's Office noted that California's number of aerospace jobs had shrunk from 337,000 in 1990 to 191,000 in 1994. As is to be expected in a recession, construction also took a dive. The number of new residential building permits, which had peaked at nearly 315,000 in 1986, was under 85,000 in 1993 and didn't exceed 100,000 again until 1997. To put that peak-to-trough drop of 230,000 in perspective, it was greater than

Chart 9 & 10: Unemployment in the U.S. and California, 1960–2010



In most years, California unemployment has been above U.S. rates. Until the 2000s, net migration to California rose when that gap closed or narrowed.

Sources: U.S. Bureau of Labor Statistics; California Dept. of Finance. Migration as percentage of population calculated from state DOF annual migration totals based on population for prior year.

the total number of permits issued in any year of the 2000s building boom.

Taxes were also on the rise during the early 1990s, though political signals may have had more impact at the time than the actual dollar amounts. According to Tax Foundation data, the overall state and local tax burden in California rose from 10.0 percent of income in 1988 to 10.6 percent in 1992. California's increase was not much more than that of the U.S. as a whole (which saw a rise from 9.7 percent to 10.1 percent), but it sent some troubling signals

to job-producing businesses. One was that the state government, which had powered through the 1980s without resorting to any broad-based tax hikes, suddenly seemed unable to pay its bills. Another was that the tax revolt that had started with Proposition 13 in 1978 seemed to be out of gas. When the new Republican governor, Pete Wilson, signed off on a \$7 billion tax increase in 1991, it was a sign that California's political leaders had abandoned any notion of trying to spur growth through tax cuts. Wilson's revenue enhancers were temporary, and, coincidentally or not, the state recovered briskly after they expired in

the mid-1990s. But as the state later learned in the 2000s, its fiscal distress was far from over.

Another factor that may have hurt California's economic competitiveness at the end of the 1980s was that decade's dramatic spike in real-estate prices. Home values increased in most states during the 1980s, but in California they rose far more. According to Census data, the state's median home values were consistently above national averages in 1940, 1950, 1960, and 1970 but never by more than 36 percent. By 1980, they were 79 percent higher. By 1990, they were 147 percent higher. This was a boon to those Californians who wanted to cash out on their expensive homes and move to cheaper locales. But for employers looking to fill positions in California, it added to the cost of labor there in comparison with other states. The Texas median home price in 1990, for instance, was less than one-third of California's.

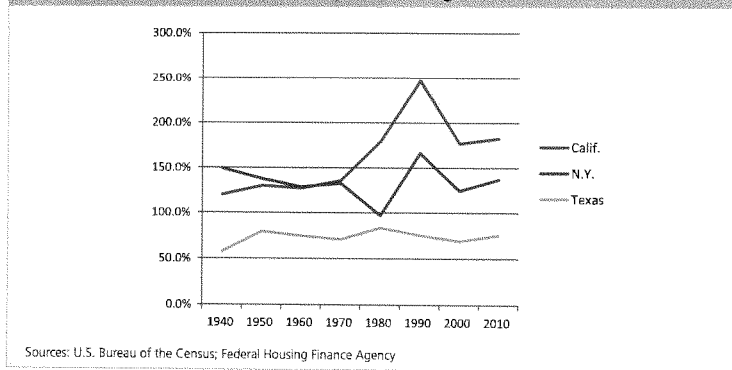
Looking back on the population surge of the 1980s, it's easy to see why housing prices soared. They were obeying the law of supply and demand, with a boost from the sharp reduction in property taxes brought about by Proposition 13 (then, as now, property taxes were capped at 1 percent of a home's purchase price, plus an adjustment of no more than 2 percent per

year). During the 1980s, the state gained 6,092,257 residents, and builders struggled to keep up by adding 1,903,841 housing units, or fewer than one for every three new Californians; in the previous decade, the ratio had been one-to-1.6. Added to sheer demand for housing was the fact that California was growing short on buildable land. This was due both to geography and policy. The most desirable parts of the state are near the coast, where land use was becoming increasingly restrictive. Cities and counties imposed growth controls, and more and more land was placed off-limits as permanent public open space or preserved farmland. We recognize that many factors go into the price of homes, so it is impossible to determine how much of the California premium was due to building restrictions, land-use rules, land scarcity, demand for housing, or tax policy. We can only note that all these factors played a role and that their combined effect was to make housing far more costly in California than in most other states.

B. The Density Factor

As California saw its economy struggle, it was also becoming a more crowded state. At some point late in the last century, people moving to California could no longer assume that they would have more living

Chart II: California, New York, and Texas Median Home Values as Percentage of U.S. Inflation-Adjusted Average, 1940–2010



space and less congestion. Despite stereotypes about suburban sprawl, California's development since at least the 1980s has followed the "smart growth" model of closely packed residential clusters separated by open space. As a result, California had the densest urbanized areas in the nation by 2010. According to the Census, the Los Angeles and Orange County region had a population density of 6,999.3 per square mile—well ahead of famously dense metro areas such as New York and Chicago. In fact, the Los Angeles and Orange County area was first in density among the 200 largest urban areas in the United States. The San Francisco/Oakland area came in second, at 6,266.4; San Jose was third, at 5,820.3. The New York–New Jersey area followed, at 5,318.9. By way of comparison, the Chicago urban area ranks 25th, with a density of 3,524, and Houston is 37th, at 2,978.5. Of the 50 densest large urban areas in the country, 20 are in California.

This crowding takes its toll. California's great coastal cities may still be exciting places to live, but they are no longer convenient—at least not by the standards of the 1960s and 1970s, when the freeways were new and not yet clogged. The

crowding of coastal California was well under way by 1990, reflected not just in housing costs but also by a major migration within the state to roomier (if hotter) inland counties. In part because of this population shift, California is, in some ways, two distinct states: a coastal zone with an entertainment and technology-driven economy and liberal politics; and a more conservative inland region that makes its money from agriculture and, in and near Kern County, oil. One of the big migration stories of the past two decades has been eastward movement into those inland counties, where much of the farmland has given way to homes. Table 2 shows how this internal migration affected counties during the first decade of the 2000s. Among the state's larger counties, those with the highest out-migration rates (Los Angeles, San Francisco, Alameda, Santa Clara, San Mateo, Monterey, and Orange) are all on or near the coast. Large inland counties such as Kern, Riverside, and Placer had double-digit rates of net in-migration. The same factors that drive this eastward movement, such as the desire for more space and affordable homes, might also be driving much of the migration from California to more spacious neighboring states.

Table 7: California Counties: Components of Migration 2000–10

	Foreign	Domestic	Net Migration		Domestic
	Immigration	Migration	Number	Rate	Migration Rate
California State	1,669,436	-1,434,082	235,354	0.7%	-4.2%
Alameda	105,147	-158,876	-53,729	-3.7%	-11.0%
Alpine	14	-117	-103	-8.6%	-9.7%
Amador	176	3,658	3,834	10.9%	10.4%
Butte	2,139	12,498	14,637	7.2%	6.1%
Calaveras	243	5,063	5,306	13.1%	12.5%
Colusa	1,056	-654	402	2.1%	-3.5%
Contra Costa	42,271	-6,879	35,392	3.7%	-0.7%
Del Norte	209	399	608	2.2%	1.5%
El Dorado	2,563	14,514	17,077	10.8%	9.2%
Fresno	29,447	1,248	30,695	3.8%	0.2%
Glenn	688	-1,039	-351	-1.3%	-3.9%
Humboldt	871	4,210	5,081	4.0%	3.3%
Imperial	16,597	-4,700	11,897	8.3%	-3.3%
Inyo	205	279	484	2.7%	1.5%
Kern	21,933	69,620	91,553	13.8%	10.5%

Kings	3,641	2,353	5,994	4.6%	1.8%
Lake	817	6,260	7,077	12.1%	10.7%
Lassen	151	-123	28	0.1%	-0.4%
Los Angeles	504,960	-1,126,185	-621,225	-6.5%	-11.8%
Madera	3,207	9,205	12,412	10.0%	7.4%
Marin	5,948	-10,117	-4,169	-1.7%	-4.1%
Mariposa	110	1,242	1,352	7.9%	7.3%
Mendocino	1,429	-2,925	-1,496	-1.7%	-3.4%
Merced	9,461	6,926	16,387	7.8%	3.3%
Modoc	97	247	344	3.6%	2.6%
Monro	192	-89	103	0.8%	-0.7%
Monterey	19,975	-56,729	-36,754	-9.1%	-14.1%
Napa	4,927	2,947	7,874	6.3%	2.4%
Nevada	566	7,061	7,627	8.3%	7.7%
Orange	150,997	-257,366	-106,369	-3.7%	-9.0%
Placer	4,861	80,254	85,115	33.8%	31.9%
Plumas	122	-412	-290	-1.4%	-2.0%
Riverside	59,202	408,762	467,964	30.1%	26.2%
Sacramento	50,671	30,286	80,957	6.6%	2.5%
San Benito	1,898	-6,208	-4,310	-8.0%	-11.6%
San Bernardino	54,167	63,814	117,981	6.9%	3.7%
San Diego	129,924	-114,342	15,582	0.6%	-4.0%
San Francisco	91,486	-90,034	1,452	0.2%	-11.6%
San Joaquin	29,738	26,646	56,384	9.9%	4.7%
San Luis Obispo	3,968	12,376	16,344	6.6%	5.0%
San Mateo	47,546	-89,646	-42,100	-5.9%	-12.7%
Santa Barbara	13,004	-20,028	-7,024	-1.8%	-5.0%
Santa Clara	135,798	-214,696	-78,898	-4.7%	-12.7%
Santa Cruz	9,107	-19,875	-10,768	-4.2%	-7.8%
Shasta	1,198	10,488	11,686	7.1%	6.4%
Sierra	31	-308	-277	-7.7%	-8.5%
Siskiyou	430	689	1,119	2.5%	1.6%
Solano	18,255	-31,208	-12,953	-3.3%	-7.9%
Sonoma	11,415	-7,463	3,952	0.9%	-1.6%
Stanislaus	16,336	3,632	19,968	4.4%	0.8%
Sutter	7,473	1,148	8,621	10.9%	1.4%
Tehama	642	5,603	6,245	11.2%	10.0%
Trinity	40	1,245	1,285	9.9%	9.6%
Tulare	12,854	9,248	22,102	6.0%	2.5%
Tuolumne	314	1,410	1,724	3.2%	2.6%
Ventura	30,353	-31,882	-1,529	-0.2%	-4.2%
Yolo	7,193	10,715	17,908	10.5%	6.3%
Yuba	1,373	3,773	5,146	8.5%	6.3%

Source: California Dept. of Finance annual population estimates with components of change.

C. The Fiscal Distress Effect

During the late 1990s, thanks to the rise of the dot-com economy, California was thriving again and its government operated with a surplus. The state saw good times in the following decade as well. Massive trade through its harbor helped revive Los Angeles, big new things in technology kept the Bay Area (home of Google and Apple) humming, and homebuilders were back in business everywhere. By mid-decade, the jobless gap with the U.S. average was almost closed.

Despite this upturn, though, people did not flock to California as they had in the past. Instead, the exodus that started around the 1990 recession resumed and showed no signs of stopping. In the 2000s, net domestic out-migration actually rose as the economy grew, peaking at 317,437 in the fiscal year ending June 30, 2006. The exodus rate remained high—still more than 300,000—as the national economy weakened in 2009 and migration in general slowed down. In California's history, an economic boom had usually been followed by an influx of migrants. What had happened to break that connection?

The public sector's fiscal instability may have been the culprit. This was not a new problem, but it became more severe and obvious after the turn of the century. California's volatile tax structure (it depends heavily on corporate profits and income from capital gains) and its inability to restrain spending in high-revenue years made the state government increasingly vulnerable to a recessionary shock. In the early 2000s, that shock arrived.

Even before that blow, the state went through a chaotic period of power shortages and rate spikes due to a botched deregulation scheme. Political upheaval—2003 marked the first and only recall of a sitting governor—muddled the outlook further. By 2003, California's Standard & Poor's bond rating was BBB, the worst in the nation, and it was patching together budgets through short-term borrowing and accounting tricks. When recovery arrived in the middle of the decade, it did not resolve the structural imbalances between revenues and spending. So the

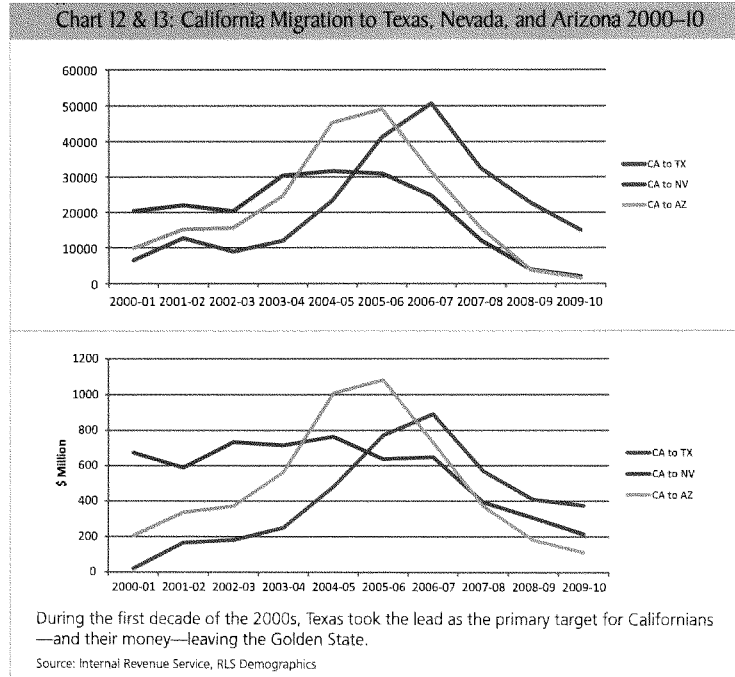
state was again deep in the red as recession set in later in the decade, and a number of its cities were heading toward bankruptcy. As of 2012, it once again had the lowest S&P rating in the nation: A-, one step above BBB.

Fiscal distress in government sends at least two discouraging messages to businesses and individuals. One is that they cannot count on state and local governments to provide essential services—much less, tax breaks or other incentives. Second, chronically out-of-balance budgets can be seen as tax hikes waiting to happen, with businesses and their owners the likeliest targets to tap for new revenue. For example, the state government's fiscal troubles have led to an initiative, Proposition 30, on the ballot this November, which asks the state's voters to approve increases in sales and income taxes. In contrast, a fiscally competent state inspires confidence that it can sustain its services without unpleasant tax surprises. Even when that state's tax burden is on the high side, it's at least predictable. Businesses there can forecast their costs with some confidence. California, as its credit status indicates, is now the biggest gamble among the states. It has been that way for most of the past decade. To the degree that fiscal distress sends businesses elsewhere, it does the same with jobs and helps explain the migration data.

INDIVIDUALS' REASONS TO LEAVE CALIFORNIA

I. Jobs

A closer look at movement to and from the top three destination states for Californians—Texas, Nevada, and Arizona—shows the impact of the 2008–09 recession on migration in general. People simply did not move as much because there were fewer jobs to attract them. But even with the recession impelling people to stay put, Texas had a relatively strong pull on Californians. Texas's net inflow from California between 2009 and 2010 was 14,963. That's small compared with the population of either state but is impressive in the context of a major economic downturn. According to the IRS data, the



next biggest beneficiary in that period for net migration from California was Oregon, at 5,708 net gain, followed by the state of Washington, at 4,741. Arizona and Nevada, the two most popular destination states at the start of the decade, netted only 3,653 between them from California in the decade's last year. This is consistent with our hypothesis that these states are destinations for retiring Californians, as the economic crisis put retirement plans on hold for many who suffered losses in real estate or the stock market.

Much of the explanation for individual decisions to leave California can be found by considering the changing status of Texas in the data. At the turn of the century, Texas lagged behind Nevada, Arizona,

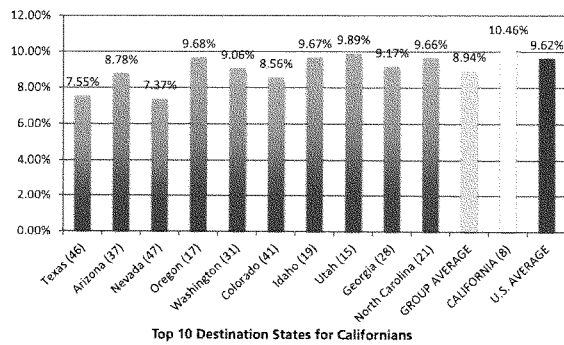
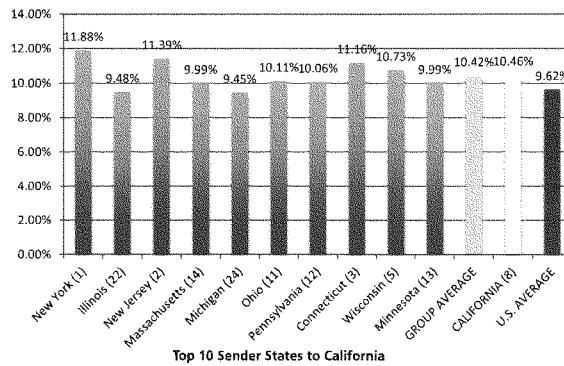
and Oregon as a destination for Californians. In 2010, it had moved to the top of the list. Why did that happen? Unlike nearby states, Texas is not an obvious destination for Californian migrants. Most of its population centers are some 1,000 miles away from the big California metro areas.

What it has had, for the past few years, is an economy that, compared with California's, is booming. This is a quite recent development. In fact, California and Texas had comparable unemployment rates through 2006 (in the summer and fall of that year, both rates bottomed, at just under 5 percent). But starting in 2007—well before the recession—California's jobless rate started climbing and eventually

left Texas far behind. By July 2010, the gap was 4.3 percentage points: 8.1 percent for Texas and 12.4 percent for California. It is not surprising, then, that Texas kept pulling Californians by the tens of thousands as the decade waned, while nearer destination states saw the earlier wave of Californians slow to a trickle.

Texas is not the only east-of-the-divide state to attract more Californians as the decade wore on. Its

Chart 14 & 15: Average State and Local Tax Burdens, 2000–09



Here are average state and local tax burdens for 2000–09, as a share of income, in the top 10 sender states to California (top chart) and the top 10 destination states (lower in the 2000–10 decade). They are shown left to right by the size of their net migration to or from California. Tax burden ranks (with 1 the largest) are in parentheses.

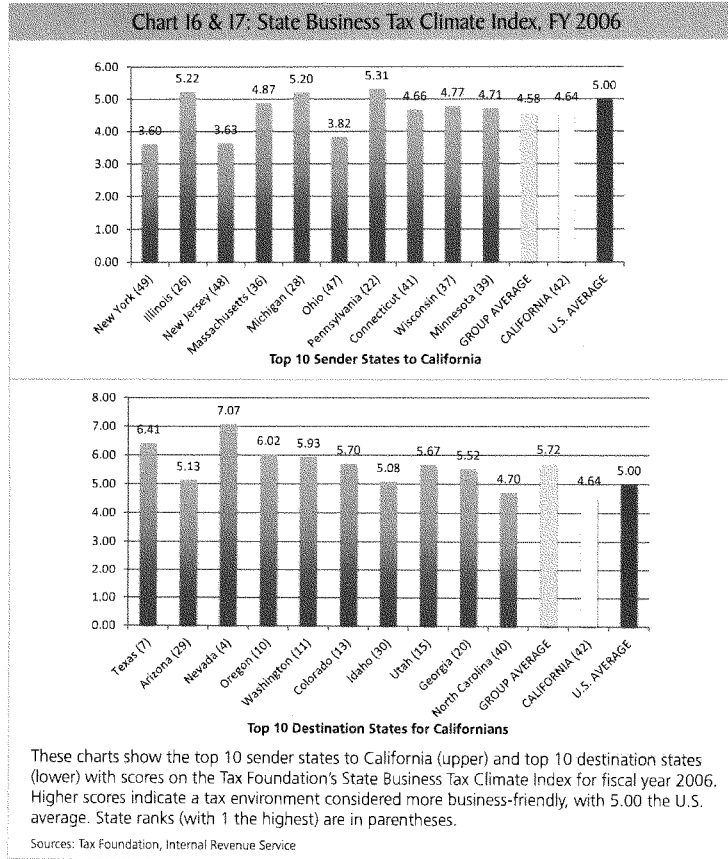
Sources: Tax Foundation, Internal Revenue Service

smaller neighbor Oklahoma was a minor target state in 2000–01, with net migration from California totaling only 775. Ten years later, it was the sixth-most popular target. It netted 2,152 from California in 2009–10, amid the sluggish migration of the recession. Oklahoma's job market was stronger than California's throughout the decade, but the jobless gap between

the two states was much wider in 2010 (5.5 percent) than it had been ten years earlier (1.9 percent).

2. Taxes

Most of the destination states favored by Californians have lower taxes. Even Oregon, with income-tax rates



like those of California, has a more business-friendly tax code. On the other side of the migration ledger, the states that are still net senders of people to California range from near the middle of the tax scale to the very top. As a general rule, Californians have tended to flee high taxes for low ones.

Whether this is why they move is a matter of debate. With so many factors possibly influencing the decision to migrate, it's impossible to tease out how much the tax burden matters in each individual's case. But, as we have noted, individual decisions in the aggregate add up to suggestive patterns. California remains a destination for people moving from high-tax states even as it loses thousands of people every year to low-tax states. This is a highly suggestive pattern.

Even as individual motives are varied and idiosyncratic, we must also note that not all migration is driven by such household choices. Businesses affect migration patterns by their choice of where to relocate or expand. Theirs is largely an economic decision, based on costs as well as access to suppliers and customers. We can say with some confidence that business decisions to leave California are sensitive to its tax code because taxes are a large component of business costs, and no competent business owner will ignore them. Taxes are a significant factor in business migration along with the cost of labor, the skills of the workforce, utility costs, and the time and expense of getting permits.

To explore the tax-migration link, we looked at two types of tax ratings in the destination states for Californian out-migration and the states from which new migrants came to California in 2000–10. One rating is based on the overall state and local tax burden, computed by the Tax Foundation as a percentage of personal income. The other is the Tax Foundation's State Business Tax Climate Index. This is given as a score for which the U.S. average is 5.00. The higher the index score, the better the climate. To match these data sets as much as possible to the full-decade migration totals, we averaged tax-burden figures and state ranks for 2000–09 (the latest available), and we chose the State Business Tax Climate Index at mid-decade,

for the fiscal year ending in 2006. The top ten target states attracted a net total—the difference between total inflows and outflows—of 1,085,818 Californians over the decade. Texas attracted the most, at 225,111. The top ten source states sent a net total of 152,324 to California, with New York sending the most, at 31,434.

One pattern stands out in these data. With few exceptions, the states that have gained the most at California's expense (in income as well as people) have decidedly lower tax burdens and better business-tax climates. California's ranking on both scales is near the high-tax, poor business-climate end, and it scores near the average of the sender states, most of which share its poor marks. The major destination states, on average, do better than California in the rankings, with lower tax burdens and higher business-climate scores.

We have also found another clue suggesting that taxes make a difference in migration: California's net out-migration to the top destination states was far larger than what it received from the sender states. In other words, with its higher-than-average tax burden, California is competitive only with a few other high-tax states, such as New York and New Jersey. And its burden is too close to the top to leave it any real advantage. The much greater advantage lies with low-tax states such as Texas, which can offer more substantial savings.

3. Other Costs

Employers may be especially sensitive to California's tax bite because the state's other business expenses are so high. One 2005 study, by the Los Angeles-based Milken Institute, ranked California fourth-highest in the nation on a broad cost-of-doing-business index. (The Milken Institute's last survey of this type, in 2007, used slightly different methodology but put California almost as high, at sixth.) Among other factors, California's 2005 electricity-cost index was 168.0, on a scale in which 100 was the U.S. average. Industrial rents were 36.8 percent above the national average, and office rents were 36.3 percent higher. The state's tax-burden

index was not as outsize—111.1—but combined with the other factors, it helped push the state to an overall cost index of 124.2.

This index, like other gauges of business cost, leaves out the impact of California's regulations. These are important factors, even if their impact is hard to measure precisely: quantifying the cost of delays, paperwork, and uncertainty due to unfriendly laws and bureaucrats is not an exact science. Business-climate surveys by such publications as *Forbes* and *Chief Executive* consistently rank California near the bottom in the regulation category.

Then, too, most of the states gaining population at California's expense do not require workers to join a union when their workplace is represented by one. Of the ten top destination states, seven (Texas, Arizona, Utah, Idaho, Nevada, Georgia, and North Carolina) have right-to-work laws that explicitly ban the compulsory union shop.

In sum, we can identify a number of cost drivers—taxes, regulations, the high price of housing and commercial real estate, costly electricity, union power, and high labor costs—that offer incentives to businesses to locate outside California, thus helping to drive the exodus.

Time will tell if the century's second decade continues the migration trend of the previous ten years. What seems unlikely to change, though, is California's poor position relative to other states in the competition for jobs and business expansion. The Tax Foundation's latest (2012) State Business Tax Climate Index ranks California less favorably than 47 other states. In 2011, the Milken Institute ranked 200 U.S. metropolitan areas according to their growth in jobs and wages, and only one California metro area, Bakersfield, made the top 50 (at 46th). The Milken survey also suggests that the past decade's destination states haven't lost their appeal. Of the 50 highest-ranked metro areas, 22 were in the top ten destination states, with 11 in Texas alone. Only eight of the top 50 areas were in the top ten sender states. The two biggest senders of migrants to California—New York and Illinois—had no high-growth cities at all.

Another unchanging aspect of the situation is California's perilous public-sector fiscal health. As we noted above, it currently ranks last on this score among states, as measured by its S&P credit rating. In fact, California was the only state in 2012 with an A rating, six notches below the top rating of AAA. Interestingly, of the ten states that sent the most people to California in the past decade, eight are high-tax jurisdictions—and the only two that are not, Illinois and Michigan, had low credit ratings. (Illinois is rated A+ because of one of the nation's worst burdens of unfunded pension obligations, and Michigan's rating declined during the 2000s from AAA to AA- as the auto industry struggled and shed employment.)

CONCLUSION: WHY MIGRATION MATTERS

In and of themselves, raw population statistics are not of much significance. A small nation (or U.S. state) can be rich in per-capita terms, which is what matters to its residents. And a large one can be poor. When a U.S. state's population growth slows or stops entirely, it suffers some direct but limited losses. Its share of the electoral college and the House of Representatives shrinks, and it loses some bragging rights. Otherwise, many people don't feel the impact of migration within the United States.

But population change, along with the migration patterns that shape it, are important indicators of fiscal and political health. Migration choices reveal an important truth: some states understand how to get richer, while others seem to have lost the touch. People will follow economic opportunity. The theme is clear in the data: states that provide the most opportunity draw the most people.

California has an opportunity deficit that shows up in its employment data and its migration statistics. We can understand the nature of that deficit clearly when we compare the Golden State with those that lure its residents away. In such a comparison, as we have seen, one fact leaps out: living and doing business in California are more expensive than in the states that

draw Californians to migrate. Taxes are not the only reason for this, but we have highlighted their effect because taxes—unlike rents, home prices, wages, or electric bills—can be changed through sheer political willpower.

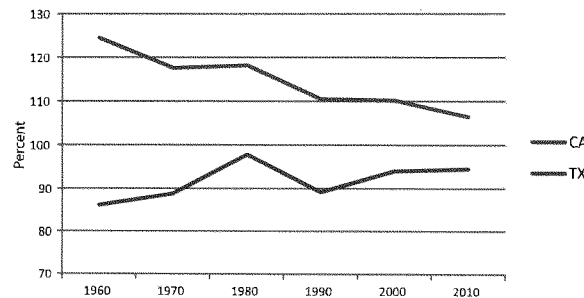
California has cut taxes in the past, most dramatically with 1978's Proposition 13, and when it has done so, prosperity has followed. Ballot propositions this November aim to do the reverse, raising taxes on business owners while the state is still struggling to hold its own against more aggressive, confident rivals. The results will send a strong signal, whichever way they go: the state's voters will be deciding to continue on the path of high taxes and high costs—or to make a break with the recent trend of decline.

In the meantime, California's leaders are not powerless to stem the state's declining appeal. For example, they certainly can do something about the instability

of public-sector finances, which is likely one of the key factors pushing businesses and people toward other states. They can also rethink regulations that hold back business expansion and cost employers time and money. And though there is no changing the fact that California is more crowded than it used to be and is no longer as cheap a place to live as it once was, policies can make the state more livable. One reason that land is costly now is that much of it is placed off-limits to development. Spending on transportation projects where they are really needed—in congested cities—can ease life on freeways that now resemble parking lots.

California's economy remains diverse and dynamic; it has not yet gone the way of Detroit. It still produces plenty of wealth that can be tapped by state and local governments. Tapping that private wealth more wisely and frugally can go far to keep more of it from leaving.

Chart 18: California and Texas per Capita Income as % of U.S. Average, 1960–2010



Source: National Bureau of Economic Research

APPENDIX: HOW IRS DATA IS USED TO ANALYZE MIGRATION

The IRS/Census processing of tax-return data involves the matching of returns between two tax filing years. The returns are matched on the primary tax-filer ID (Social Security number). When a match is found, the return is coded to the appropriate address—or addresses, in the case of a migrant return. The IRS then looks at the number of individuals represented in the return, via the number of exemptions claimed. In most cases, the exemptions will be the taxpayers and dependent children. Hence, counting by exemptions provides an accurate count of the number of people who have moved. The IRS data provide a count of the number of returns (with, in each return, the number of exemptions) that have changed address between one year and the next.

[Whereupon, at 11:50 a.m., the hearing was adjourned.]
[Additional material submitted for the record follows.]

Ocean access to a cavity beneath Totten Glacier in East Antarctica

J. S. Greenbaum^{1*}, D. D. Blankenship¹, D. A. Young¹, T. G. Richter¹, J. L. Roberts^{2,3}, A. R. A. Aitken⁴, B. Legresy^{2,5,6}, D. M. Schroeder⁷, R. C. Warner^{2,3}, T. D. van Ommen^{2,3} and M. J. Siegert⁸

Totten Glacier, the primary outlet of the Aurora Subglacial Basin, has the largest thinning rate in East Antarctica^{1,2}. Thinning may be driven by enhanced basal melting due to ocean processes³, modulated by polynya activity^{4,5}. Warm modified Circumpolar Deep Water, which has been linked to glacier retreat in West Antarctica⁶, has been observed in summer and winter on the nearby continental shelf beneath 400 to 500 m of cool Antarctic Surface Water^{7,8}. Here we derive the bathymetry of the sea floor in the region from gravity⁹ and magnetics¹⁰ data as well as ice-thickness measurements¹¹. We identify entrances to the ice-shelf cavity below depths of 400 to 500 m that could allow intrusions of warm water if the vertical structure of inflow is similar to nearby observations. Radar sounding reveals a previously unknown inland trough that connects the main ice-shelf cavity to the ocean. If thinning trends continue, a larger water body over the trough could potentially allow more warm water into the cavity, which may, eventually, lead to destabilization of the low-lying region between Totten Glacier and the similarly deep glacier flowing into the Reynolds Trough. We estimate that at least 3.5 m of eustatic sea level potential drains through Totten Glacier, so coastal processes in this area could have global consequences.

The Totten Glacier drains into the Sabrina Coast in an area where we find coastal ice grounded below sea level and the potential for local marine ice sheet instability¹² upstream of the grounding line (Fig. 1b). We infer the bathymetry seaward of the grounding line using inversions of gravity data⁹ informed by magnetics data¹⁰ and ice-thickness measurements¹¹. The inversion reveals the southwest area of the Totten Glacier Ice Shelf (TGIS) cavity is the deepest, reaching 2.6 ± 0.19 km below sea level (Fig. 2), comparable to the grounding line depths of Amery Ice Shelf¹³ and the segment of the Moscow University Ice Shelf (MUIS) overlying the Reynolds Trough¹⁴. The shallowest area of the cavity (~ 300 mbsl) is found beneath the calving front of the ice shelf where a large coast-parallel ridge connects Law Dome with a peninsula of grounded ice protruding from the east side of the cavity (Fig. 2). The ridge extends 40 km seaward of the calving front and would have been a source of backstress on the Totten Glacier as recently as 1996 when ice rises were last detected¹⁴. The inversion reveals depressions located near the centre of the ridge (650 ± 190 mbsl) and to the east of the grounded ice peninsula (860 ± 190 mbsl) (Fig. 2, Profile A–A'). Looking along the long axis of the full Totten cavity we see it is an average of 500 m deeper along the western (Law Dome) side. We

infer two basins on the long axis reaching depths of 2.6 ± 0.19 km and 1.9 ± 0.19 km (SW and NE, respectively; Fig. 2) separated by a narrow ridge causing an ice rise near the middle of the ice shelf (the left-hand panel in Fig. 2)¹⁴.

Published grounding lines^{14,15} indicate an area of grounded ice bounded by the MUIS to the north and an eastward extension of the TGIS to the south (Fig. 3). We use hydrostatic calculations and basal reflection and specularly analyses from radar data to show that a subglacial oceanic trough connects through this zone beneath nearly 1,000 m of floating ice. We identify floating ice by comparing the observed ice-surface elevation to that computed from concurrently measured ice thickness assuming hydrostatic equilibrium¹⁶ (Fig. 3). The hydrostatic criterion is sensitive to an uncertain firn model¹⁷ so we analyse five lines to investigate where ice is floating: two lines crossing the trough acquired one year apart (Profiles C and D) and lines on either side, sampling areas known to be floating, where the firn is likely to be similar. Line segments sampling the trough (red points) and nearby areas known to be floating (yellow, orange, and cyan) lie along the hydrostatic line (Fig. 3a), indicating that the modelled firn thickness is acceptable for this area and that the ice over the channel is also floating. Profiles A and B reveal floatation westward of the published grounding line. The area of the trough that we find to be in hydrostatic equilibrium corresponds to where a radar satellite image¹⁸ suggests steep slopes bounding an ice-surface depression (transparent overlay in Figs 2 and 3).

The width of the trough would be just over 4 km if it were defined by hydrostatic criteria alone. However, the true grounding line is often landward of the hydrostatic point owing to rigidity in floating ice; so, other techniques must be used to infer the extent of subglacial water. Profile D–D' in Fig. 3 illustrates that the basal reflectivity over the trough is 10 to 15 dB higher than on either side. Established radar literature demonstrates the relative reflected power of seawater and unfrozen bedrock is ~ 12 dB (refs 19–21), providing confidence in our interpretation that the ice over the trough floats on seawater. This is consistent with the bright region beginning near easting 2,245 km in the radargram included in Fig. 3. Taking the area of elevated reflectivity to represent water between the true grounding line and where the ice is in full hydrostatic equilibrium, we find that the trough is closer to 4.9 km across.

We investigate the character of the ice–water interface over the trough using the specularly of the basal radar returns²² along Profile D–D'. The proportion of specular to diffuse energy in radar bed echoes is used to identify subglacial water²² because melt processes

¹Institute for Geophysics, University of Texas at Austin, Austin, Texas 78758, USA. ²Antarctic Climate & Ecosystems Cooperative Research Centre, University of Tasmania, Private Bag 80, Hobart, Tasmania 7001, Australia. ³Australian Antarctic Division, Channel Highway, Kingston, Tasmania 7050, Australia. ⁴School of Earth and Environment, The University of Western Australia, Perth, Western Australia 6009, Australia. ⁵CSIRO Oceans and Atmosphere Flagship, Castray Esplanade, Hobart, Tasmania 7000, Australia. ⁶CNRS-LEGOS, 14 Av. E. Belin, 31400, Toulouse, France. ⁷Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109, USA. ⁸Grantham Institute and Department of Earth Sciences and Engineering, Imperial College London, London SW7 2AZ, UK. *e-mail: jsgm@utexas.edu

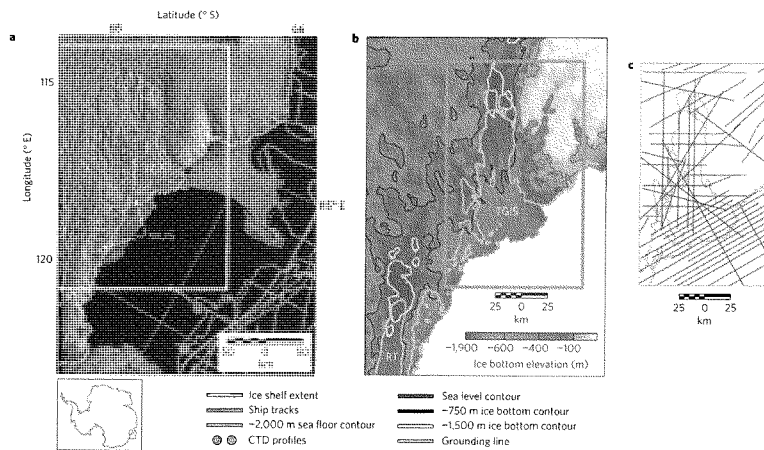


Figure 1 | Satellite imagery, a priori ice-bottom elevation map, and gravity data coverage of the study area. **a**, The Sabrina Coast with the Totten Glacier Ice Shelf (TGIS), Moscow University Ice Shelf (MUIS), Law Dome (LD) and the Reynolds Trough (RT) labelled over the MODIS-derived Mosaic of Antarctica (MOA; ref. 18). Coloured lines and marks denote the nearest available ship tracks with sea floor observations, the grounding line from data acquired in 1996 (ref. 14), ice-shelf extent¹⁵, $-2,000$ m sea floor contour²⁶, and published conductivity-temperature-depth (CTD) profiles⁷. **b**, Ice-bottom elevation derived from ice-sounding radar identifying a low-lying area between the TGIS and RT in the region indicated by the white box in **a**. **c**, Airborne gravity lines (black) used in the 3D inversion which was computed within the grey box outlined in **b**.

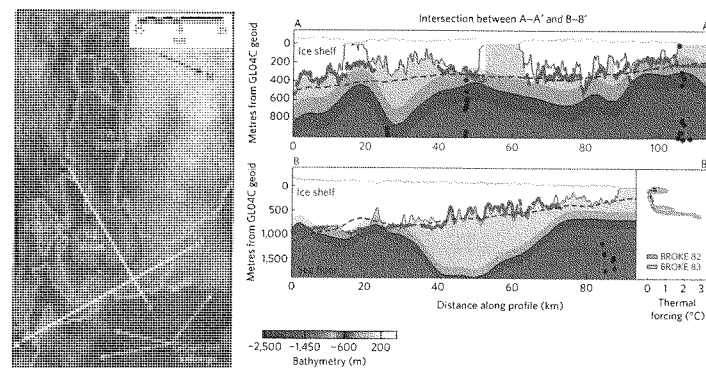


Figure 2 | Shape of the sea floor beneath the Totten Glacier Ice Shelf. Left-hand panel: The TGIS bathymetry is plotted with the MOA (ref. 18) (partially transparent), map area as the same as Fig. 1c. A basement ridge, major basins, grounded icebergs (Supplementary Movies) and the eastern Totten Glacier Grounding Zone (TGGZ) are labelled for reference. Profile A-A' crosses the major oceanic entryways. Profile B-B' crosses a major ice rise, the NE Basin and the basement ridge; thermal forcing computed from published CTD profiles from the BROKE expedition (ref. 7; locations shown in Fig. 1) is plotted using the same vertical scale. Laser-derived ice-surface elevation (thin blue line), ice-bottom elevation from radar sounding (where available; thick blue points), and ice-bottom elevation computed from the surface elevation assuming flotation (medium blue line) are plotted above the inverted sea floor (brown). Grey shading in both profiles represents the estimated root mean square error between inverted and measured depths. Depth to magnetic basement solutions (black points) and the Bedmap 2 sea floor²⁶ (dashed black line) are also plotted.

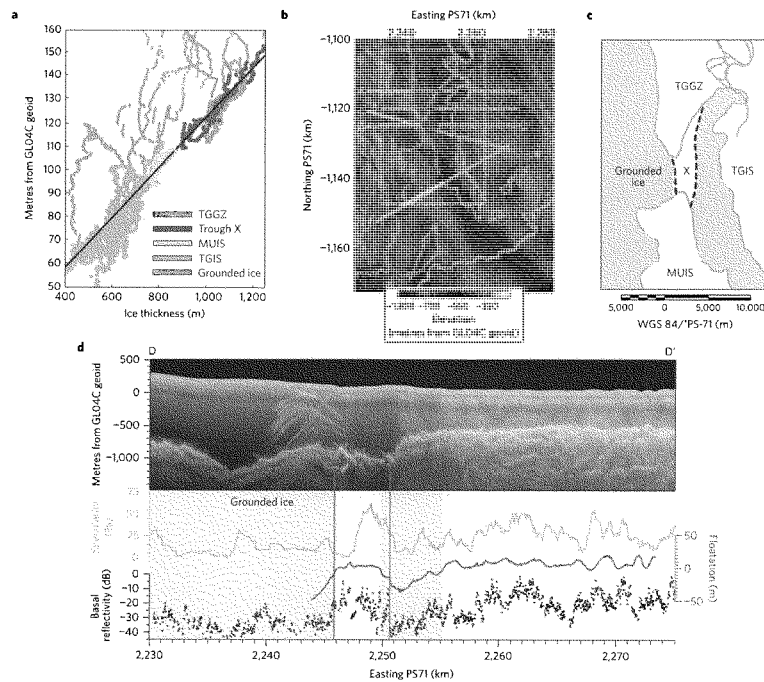


Figure 3 | A newly discovered oceanic entryway to Totten Glacier. **a**, Ice-surface elevation against ice thickness for the five profiles shown in **b**; the black line represents theoretical flotation. Red points sample the new trough ('Trough X'); yellow, orange and blue points sample previously known floating areas of the MUIS, TGGZ and the TGIS, respectively. **b**, Inverted bathymetry of the northeast area of the TGIS and MOA (ref. 18; partially transparent). **c**, Expanded map of the area outlined in the rectangle in **b** presenting the approximate extent of Trough X (dashed lines). **d**, (Top) Radargram for Profile D-D'. (Bottom) Basal echo strength (black points), hydrostatic anomaly (blue line), and basal specularity (orange line) for Profile D-D' are shown with the same horizontal scale as the radargram. The proposed extent of Trough X along Profile D-D' is indicated by the red vertical lines.

smooth the overlying ice, increasing the specularity of the interface. We find high specularity in the trough, extending to the same approximate western extent as the elevated reflectivity, supporting the inference that seawater is found beyond where the ice reaches hydrostatic equilibrium. We find that the ice–water interface in the western half of the trough is more specular than anywhere else along the profile, including the area previously known to be an ice shelf. Combined with hydrostatic equilibrium and elevated basal reflectivity, the high specularity on the western side provides further evidence that smoothing of the interface due to basal melting is underway and that water is present in the trough. Low specularity in the eastern half of the trough indicates a transition in the geometry of the interface, possibly where basal crevasses produce a diffuse scattering environment (Fig. 3).

Based on our analysis of radar data, we suggest the trough width is nearly the same as the half-wavelength of the gravity data and, therefore, near the limit of detectability. This limitation makes a narrow feature difficult to model by inversion as the gravity

signal from the two sides is smeared over the trough. However, a short-wavelength gravity low over the trough area (Supplementary Figs 5 and 6) suggests a shallow topographic low where radar results indicate the ice is floating. Simple profile modelling of this gravity line constrained by the radar results implies that the depth of the trough could be as much as 1,400 mbsl, depending on the underlying geology.

Although we are confident in the present floatation of ice over the trough, the question of why this is not reflected in published grounding lines remains. The trough is either undetectable using traditional grounding line mapping methods or floatation occurred recently. The most detailed grounding line for the Sahrina Coast was mapped using tandem double difference interferometry data acquired on the European Remote Sensing (ERS) satellites in 1996 (ref. 14). If the trough is undetectable today, it is even more likely that it was undetectable in 1996 because the ice has thinned substantially since^{1,2}. To test this, we model the tidal flexure of the ice over the trough and compare it to what would be detectable with

ERS interferometry. Modelling the ice as a 1,000-m-thick infinite beam²³ with a practical modulus of elasticity from the literature²⁴ supported by the walls of a water-filled 4.9-km-wide trough, we compute between 39 and 51% of full tidal deflection in the centre of the trough. The published interferogram for the TGIS reveals approximately five double difference fringes for the full range tidal signal²⁵ indicating that there would be 2 to 2.5 fringes in the centre of the trough. Coherence problems, snowfall, and tropospheric and ionospheric glitches cause noise on the level of a single fringe, making these fringes near the threshold of detectability. The complex fringe patterns in the area lead to discontinuous grounding line recovery and multiple irregular segments¹⁴ (Fig. 3). Even if fringes were detected in the middle of the trough, further interpretation would have been necessary to propose that they are caused by ice floating over a trough. Considering the ice was thicker in 1996 and would have produced an even smaller flexure signal, it is likely that floatation over the trough was not detected at that time.

Warm modified Circumpolar Deep Water (MCDW) observed on the Sabrina Coast continental shelf occupies the bottom layers of the water column, indicating that it will fill deep topography as it flows according to isobaths. This is not the case in most other coastal areas of East Antarctica, where colder, denser Shelf Water occupies the lowest layers⁷. Some have suggested this MCDW could accelerate ice-shelf melting if it enters the TGIS cavity²⁸; however, until now there was no indication that pathways of sufficient depth existed for it to do so. Previous bathymetry compilations^{26,27} interpolate across the TGIS and result in shallow topography that would not allow the observed MCDW to enter the cavity (dashed lines in Fig. 2). As a result, ocean circulation models using these compilations would potentially underestimate heat flux into the cavity. Although a blocking ridge lies beneath the calving front that was possibly a grounding line pinning-point during Holocene retreat of ice, we detect depressions in the ridge deep enough to allow MCDW to enter the cavity.

A previously unknown trough is the deepest entry to the TGIS cavity and well below the range of observed MCDW depths. At nearly 5 km across, the trough is wide enough to affect topographic steering of bottom currents, potentially routing deep layers of MCDW to an area of the coast where we find potential for local marine ice sheet instability landward of the published grounding lines. We speculate that ocean heat flux through the trough contributed to the retreat of the eastern Totten Glacier Grounding Zone (TGGZ; Figs 2 and 3) to its present position, and could contribute to further destabilization of the low-lying area between the TGIS and the similarly deep Reynolds Trough. We estimate that at least 3.5 m of eustatic sea level potential drains through Totten Glacier alone (Supplementary Information), so the area should be monitored for potential perturbations that could result in further retreat.

Although it is possible that the ice over the trough began floating recently, perhaps related to observed regional mass loss acceleration²⁶ and a 16-year-high TGIS basal melt rate⁹ that both occurred in 2006, no early data sets have adequate resolution to test this idea. Considering tidal deflection of the ice over the trough probably went undetected in 1996 and radar surface imagery suggested steep slopes on its sides in 2003, the trough probably predates published grounding lines. In either case, we expect the water column thickness over the trough to increase by several metres per year to maintain hydrostatic equilibrium if thinning trends continue^{1,2}. This could allow additional exchange between the TGIS and the ocean, accelerate ice-shelf thinning, and allow grounded ice to accelerate towards the coast. The availability of MCDW and recent accelerated mass loss support the idea that the behaviour of Totten Glacier is an East Antarctic analogue to ocean-driven retreat underway in the West Antarctic Ice Sheet (WAIS). The global sea level potential of 3.5 m flowing through Totten Glacier alone is of similar magnitude to the entire probable contribution of the WAIS

(ref. 29). Similar to the WAIS, much of the subglacial drainage basin accessible to a retreating Totten Glacier is grounded below sea level, with a potential contribution of 5.1 m (Supplementary Information), so instabilities from ice–ocean interaction in East Antarctica could have significant global consequences.

Methods

Data acquisition. The major source of observational data used herein is the International Collaboration for Exploration of the Cryosphere through Aerogeophysical Profiling (ICECAP) project, which, together with the East Antarctic component of NASA's Operation Ice Bridge mission, acquired the first comprehensive survey of the Aurora Subglacial Basin (ASB; ref. 11) and the Totten Glacier Ice Shelf (TGIS) between 2008 and 2012. The primary data sets used are laser surface altimetry, ice-sounding radar, gravity and magnetics, all acquired with the University of Texas Institute for Geophysics (UTIG) instrumentation suite aboard a ski-equipped B1-67 aircraft. The data were acquired with flights from the Australian Antarctic Division's (AAD) Casey Station. The survey was designed to cross the major axis of the TGIS to highlight channels connecting the inner continental shelf to the ice-shelf cavity. Most profiles are aligned either with the main cavity axis or parallel to the coast where the TGIS turns 20° to the west around the northeast tip of Law Dome (Fig. 1c). Tie lines and other lines of opportunity crossing the cavity were primarily used for levelling, but were included in the compilation to increase data coverage. Detailed line placement was planned to cross the grounding line (including ice rises) to provide areas to judge the quality of subsequent gravity inversions. Gravity data were acquired with a two-axis stabilized gravimeter (Bell Aerospace BGM-3) in the first three years, during which most of the data over the TGIS cavity were obtained. A modern three-axis stabilized gravimeter (Gravimetric Technologies GT-1A) was used in the fourth season to acquire the coast-parallel lines and a few others to fill coverage gaps. The coast-parallel flights were completed as a dedicated gravity survey flying at the minimum practical flight elevation and speed to increase along-track resolution. Scalar magnetic field data were acquired with a Geometrics 823A magnetometer. Meteoric ice thickness and sub-ice reflectivity characteristics were measured using the UTIG coherent, chirped very high frequency radar centred at 60 MHz (ref. 21). Ice-surface altimetry was acquired with a Riegler ice-profiling rangefinder; in addition, a 100-beam photon counting, scanning LiDAR provided ice-surface swath altimetry for approximately 50% of the line km (ref. 30).

Data analysis. Bulk density contrasts were inferred from gravity data using seven 2D profile models in the survey area. The contrasts were interpreted using total magnetic intensity, free air gravity, and depth to magnetic basement grids to infer a suite of possible geologic boundaries and bulk densities that were applied to subsequent 3D bathymetry inversions (Supplementary Information). The inversions were not constrained to areas of known grounded ice so that each result could be compared to known ice-bottom elevations and the quality of the geologic model examined. The root mean square error of the difference between the inverted and known ice-bottom elevations is used in the text as the measure of error in the inversion result. The ice-sounding radar data contains high-frequency information not detectable by airborne gravity, so the RMSE between known and inverted surfaces provides an assessment of the gravity platform's ability to reproduce realistic topography. Gravity data levelling, gridding and inversions were computed using the Geosoft Oasis Montaj software version 8.1, profile and gridded inversions were computed with the Geosoft GMSYS and GMSYS-3D extensions, respectively. Magnetics data were corrected for diurnal variations using static data acquired at Casey Station ~200 km west of the survey area, the large-scale geomagnetic reference field was removed, and the result was then levelled³¹. Depths to magnetic basement solutions were restricted to between 500 m and 10 km from the source to highlight shallow basement sources. The coast-parallel ridge along the TGIS calving front from the gravity inversion corresponds to shallow magnetic depth to basement solutions, consistent with a high-density basement composition with low rates of erosion. Agreement between positive gravity anomalies, shallow magnetic basement, ice rises and grounded icebergs (Supplementary Movies) provides confidence in the geologic model underlying the inversion result. In Fig. 2, thermal forcing was computed as the observed conservative temperature less the *in situ* freezing point for the nearest published conductivity–temperature–depth profiles³².

Received 12 December 2014; accepted 9 February 2015;
published online 16 March 2015

References

1. Flament, T. & Rémy, F. Dynamic thinning of Antarctic glaciers from along-track repeat radar altimetry. *J. Glaciol.* **58**, 830–840 (2012).

2. Pritchard, H. D., Arthern, R. J., Vaughan, D. G. & Edwards, L. A. Extensive dynamic thinning on the margins of the Greenland and Antarctic ice sheets. *Nature* **461**, 971–975 (2009).
3. Pritchard, H. D. *et al.* Antarctic ice-sheet loss driven by basal melting of ice shelves. *Nature* **484**, 502–505 (2012).
4. Gwyther, D. E., Galton-Fenzi, B. K., Hunter, J. R. & Roberts, J. L. Simulated melt rates for the Totten and Dalton ice shelves. *Ocean Sci. Discuss.* **10**, 2109–2140 (2013).
5. Khazendar, A. *et al.* Observed thinning of Totten Glacier is linked to coastal polynya variability. *Nature Commun.* **4**, 2857 (2013).
6. Jenkins, A. *et al.* Observations beneath Pine Island Glacier in West Antarctica and implications for its retreat. *Nature Geosci.* **3**, 468–472 (2010).
7. Bindoff, N. L., Rosenberg, M. A. & Warner, M. J. On the circulation and water masses over the Antarctic continental slope and rise between 80 and 150° E. *Deep Sea Res.* **47**, 2299–2326 (2000).
8. Williams, G. D. *et al.* Late winter oceanography off the Sabrina and BANZARE coast (117–128° E), East Antarctica. *Deep Sea Res.* **58**, 1194–1210 (2011).
9. Parker, R. L. The rapid calculation of potential anomalies. *Geophys. J. R. Astron. Soc.* **31**, 447–455 (1973).
10. Aitken, A. R. A. *et al.* The subglacial geology of Wilkes Land, East Antarctica. *Geophys. Res. Lett.* **41**, 2390–2400 (2014).
11. Young, D. A. *et al.* A dynamic early East Antarctic Ice Sheet suggested by ice-covered fjord landscapes. *Nature* **474**, 72–75 (2011).
12. Pollard, D., DeConto, R. M. & Alley, R. B. Potential Antarctic Ice Sheet retreat driven by hydrofracturing and ice cliff failure. *Earth Planet. Sci. Lett.* **412**, 112–121 (2015).
13. Galton-Fenzi, B., Maraldi, C., Coleman, R. & Hunter, J. The cavity under the Amery Ice Shelf, East Antarctica. *J. Glaciol.* **54**, 881–887 (2008).
14. Rignot, E., Mouginot, J. & Scheuchl, B. Antarctic grounding line mapping from differential satellite radar interferometry. *Geophys. Res. Lett.* **38**, L10504 (2011).
15. Bohlander, J. & Scambos, T. *Antarctic Coastlines and Grounding Line Derived from MODIS Mosaic of Antarctica (MOA)* (National Snow and Ice Data Center, 2007); http://nsidc.org/data/atlas/ocws/antarctic_coastlines.html
16. Bindshadler, R., Vaughan, D. G. & Vornberger, P. Variability of basal melt beneath the Pine Island Glacier Ice Shelf, West Antarctica. *J. Glaciol.* **57**, 581–595 (2011).
17. Van den Broeke, M. Depth and density of the Antarctic firn layer. *Arct. Antarct. Alp. Res.* **40**, 432–438 (2008).
18. Scambos, T. A., Haran, T. M., Fahnestock, M. A., Painter, T. H. & Bohlander, J. MODIS-based Mosaic of Antarctica (MOA) data sets: Continent-wide surface morphology and snow grain size. *Remote Sens. Environ.* **111**, 242–257 (2007).
19. Neal, C. Radio echo determination of basal roughness characteristics on the Ross Ice Shelf. *Ann. Glaciol.* **3**, 216–221 (1982).
20. Van Beek, L. Dielectric behaviour of heterogeneous systems. *Prog. Dielectr.* **7**, 69–114 (1967).
21. Peters, M. E., Blankenship, D. D. & Morse, D. L. Analysis techniques for coherent airborne radar sounding: Application to West Antarctic ice streams. *J. Geophys. Res.* **110**, B06303 (2005).
22. Schroeder, D. M., Blankenship, D. D. & Young, D. A. Evidence for a water system transition beneath Thwaites Glacier, West Antarctica. *Proc. Natl Acad. Sci. USA* **110**, 12225–12228 (2013).
23. Holdsworth, G. Flexure of a floating ice tongue. *J. Glaciol.* **8**, 385–397 (1969).
24. Vaughan, D. G. Tidal flexure at ice shelf margins. *J. Geophys. Res.* **100**, 6213–6224 (1995).
25. Rignot, E. Mass balance of East Antarctic glaciers and ice shelves from satellite data. *Ann. Glaciol.* **34**, 217–227 (2002).
26. Fretwell, P. *et al.* Bedmap2: Improved ice bed, surface and thickness datasets for Antarctica. *Cryosphere* **7**, 375–393 (2013).
27. Arndt, J. E. *et al.* The International Bathymetric Chart of the Southern Ocean (IBCSO) Version 1.0—A new bathymetric compilation covering circum-Antarctic waters. *Geophys. Res. Lett.* **40**, 3111–3117 (2013).
28. Chen, J. L., Wilson, C. R., Blankenship, D. & Tapley, B. D. Accelerated Antarctic ice loss from satellite gravity measurements. *Nature Geosci.* **2**, 859–862 (2009).
29. Baner, J. L., Riva, R. E. M., Vermeersen, B. L. A. & LeBrocq, A. M. Reassessment of the potential sea-level rise from a collapse of the West Antarctic Ice Sheet. *Science* **324**, 901–903 (2009).
30. Young, D. A. *et al.* Land-ice elevation changes from photon-counting swath altimetry: First applications over the Antarctic Ice Sheet. *J. Glaciol.* **61**, 17–28 (2015).

Acknowledgements

This project is the result of the ongoing ICECAP collaboration between the USA, UK and Australia with support from NSF grants PLR-0733025 and PLR-1143843, and CDI-0941678, NASA grants NNG10FP06G and NNX11AD33G (Operation Ice Bridge and the American Recovery and Reinvestment Act), Australian Antarctic Division projects 3013 and 4077, NERC grant NE/D00733/1, the G. Unger-Verselien Foundation, the Jackson School of Geosciences, and the Antarctic Climate and Ecosystems Cooperative Research Centre. We thank the captains and crews of Kenn Borek Airlines Ltd, ICECAP project participants, CMG Operations Pty Ltd, and the Geosoft Education Program. We also thank S. Kempf for assistance with radar data processing, as well as A. Leventer, A. Wählin, D. Gwyther, K. Soderlund, S. Zeiler, F. Habbal and C. Grima for comments on the manuscript. Part of the research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration. This is UTIG contribution 2831.

Author contributions

J.S.G. performed the gravity inversions, magnetic depth to basement estimates, hydrostatic analysis, applied the bed reflectivity corrections, and wrote the manuscript. D.D.B., D.A.Y. and A.R.A.A. assisted with the potential field interpretations. J.S.G. and T.G.R. performed the initial gravity reduction and J.S.G. levelled the result. J.L.R. estimated the sea level potential for Totten Glacier. B.L. computed the percentage deflection expected for a range of trough widths and commented on what would be detectable using existing ERS data. D.M.S. provided radar technical and interpretation guidance for the discussion of reflectivity and specularly. A.R.A.A. performed the magnetics data reduction. J.L.R., R.C.W. and T.D.v.O. provided the glaciological context for Totten Glacier. J.S.G., D.A.Y., D.D.B., T.D.v.O., J.L.R., M.J.S. and R.C.W. designed the surveys. J.S.G., D.A.Y., T.D.v.O., J.L.R. and R.C.W. collected the data. All authors contributed comments to the interpretation of results and preparation of the final paper.

Additional information


Supplementary information is available in the online version of the paper. Reprints and permissions information is available online at www.nature.com/reprints. Correspondence and requests for materials should be addressed to J.S.G.

Competing financial interests

The authors declare no competing financial interests.

2/11/2015

NASA, NOAA Find 2014 Warmest Year in Modern Record | NASA



NEWS
 News, features & press releases

MISSIONS
 Current, future, past missions & launch dates

MULTIMEDIA
 Images, videos, NASA TV & more

CONNECT
 Social media channels & NASA apps

ABOUT NASA
 Leadership, organization, budget, careers & more

[For Public](#) | [For Educators](#) | [For Students](#) | [For Media](#)

News & Features

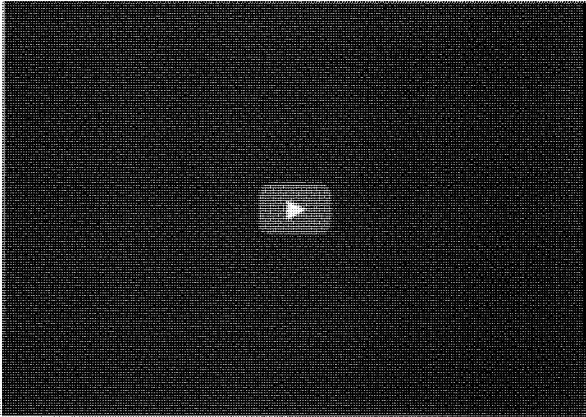
- **News Topics**
 - News Releases
 - Media Alerts
 - News Release Archives
- **Media Resources**
 - Administrator's Speeches
 - Budgets & Plans
 - Reports

Text Size 5.2K 3.9K

January 16, 2015

RELEASE 15-010

NASA, NOAA Find 2014 Warmest Year in Modern Record



The year 2014 now ranks as the warmest on record since 1880, according to an analysis by NASA scientists.

Image Credit: NASA's Goddard Space Flight Center

Download this video in HD formats from NASA Goddard's Scientific Visualization Studio

The year 2014 ranks as Earth's warmest since 1880, according to two separate analyses by NASA and National Oceanic and Atmospheric Administration (NOAA) scientists.

The 10 warmest years in the instrumental record, with the exception of 1998, have now occurred since 2000. This trend continues a long-term warming of the planet, according to an analysis of surface temperature measurements by scientists at NASA's Goddard Institute of Space Studies (GISS) in New York.

In an independent analysis of the raw data, also released Friday, NOAA scientists also found 2014 to be the warmest on record.

"NASA is at the forefront of the scientific investigation of the dynamics of the Earth's climate on a global scale," said John Grunsfeld, associate administrator for the Science Mission Directorate at NASA Headquarters in Washington. "The observed long-term warming trend and the ranking of 2014 as the warmest year on record reinforces the importance for NASA to study Earth as a complete system, and particularly to understand the role and impacts of human activity."

Since 1880, Earth's average surface temperature has warmed by about 1.4

http://www.nasa.gov/press/2015/january/nasa-determines-2014-warmest-year-in-modern-record#.VNudFtnF9_o

2/11/2015

NASA, NOAA Find 2014 Warmest Year in Modern Record | NASA

degrees Fahrenheit (0.8 degrees Celsius), a trend that is largely driven by the increase in carbon dioxide and other human emissions into the planet's atmosphere. The majority of that warming has occurred in the past three decades.

"This is the latest in a series of warm years, in a series of warm decades. While the ranking of individual years can be affected by chaotic weather patterns, the long-term trends are attributable to drivers of climate change that right now are dominated by human emissions of greenhouse gases," said GISS Director Gavin Schmidt.

While 2014 temperatures continue the planet's long-term warming trend, scientists still expect to see year-to-year fluctuations in average global temperature caused by phenomena such as El Niño or La Niña. These phenomena warm or cool the tropical Pacific and are thought to have played a role in the flattening of the long-term warming trend over the past 15 years. However, 2014's record warmth occurred during an El Niño-neutral year.

"NOAA provides decision makers with timely and trusted science-based information about our changing world," said Richard Spinrad, NOAA chief scientist. "As we monitor changes in our climate, demand for the environmental intelligence NOAA provides is only growing. It's critical that we continue to work with our partners, like NASA, to observe these changes and to provide the information communities need to build resiliency."

Regional differences in temperature are more strongly affected by weather dynamics than the global mean. For example, in the U.S. in 2014, parts of the Midwest and East Coast were unusually cool, while Alaska and three western states – California, Arizona and Nevada – experienced their warmest year on record, according to NOAA.

The GISS analysis incorporates surface temperature measurements from 6,300 weather stations, ship- and buoy-based observations of sea surface temperatures, and temperature measurements from Antarctic research stations.

This raw data is analyzed using an algorithm that takes into account the varied spacing of temperature stations around the globe and urban heating effects that could skew the calculation. The result is an estimate of the global average temperature difference from a baseline period of 1951 to 1980.

NOAA scientists used much of the same raw temperature data, but a different baseline period. They also employ their own methods to estimate global temperatures.

GISS is a NASA laboratory managed by the Earth Sciences Division of the agency's Goddard Space Flight Center, in Greenbelt, Maryland. The laboratory is affiliated with Columbia University's Earth Institute and School of Engineering and Applied Science in New York.

NASA monitors Earth's vital signs from land, air and space with a fleet of satellites, as well as airborne and ground-based observation campaigns. NASA develops new ways to observe and study Earth's interconnected natural systems with long-term data records and computer analysis tools to better see how our planet is changing. The agency shares this unique knowledge with the global community and works with institutions in the United States and around the world that contribute to understanding and protecting our home planet.

The data set of 2014 surface temperature measurements is available at:

<http://data.giss.nasa.gov/gistemp/>

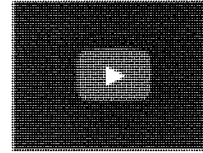
The methodology used to make the temperature calculation is available at:

http://data.giss.nasa.gov/gistemp/sources_v3/

For more information about NASA's Earth science activities, visit

<http://www.nasa.gov/earthrightnow>

http://www.nasa.gov/press/2015/january/nasa-determines-2014-warmest-year-in-modern-record#.VNudFfnf9_o



This video shows a time series of five-year global temperature averages, mapped from 1880 to 2014, as estimated by scientists at NASA's Goddard Institute for Space Studies (GISS) in New York.

Image Credit: NASA's Goddard Space Flight Center

Download this video in HD formats from NASA Goddard's Scientific Visualization Studio



This color-coded map displays global temperature anomaly data from 2014.

Image Credit: NASA's Goddard Space Flight Center

Download related visuals from NASA Goddard's Scientific Visualization Studio

2/11/2015

NASA, NOAA Find 2014 Warmest Year in Modern Record | NASA

-end-

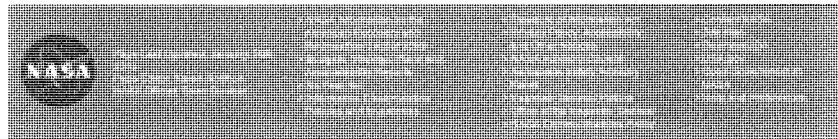
Steve Cole
Headquarters, Washington
202-358-0918
stephen.e.cole@nasa.gov

Leslie McCarthy
Goddard Institute for Space Studies, New York
212-678-5507
leslie.m.mccarthy@nasa.gov

NASA news releases and other information are available automatically by sending an e-mail message with the subject line **subscribe** to hqnews-request@newslatters.nasa.gov.

To unsubscribe from the list, send an e-mail message with the subject line **unsubscribe** to hqnews-request@newslatters.nasa.gov.

[Back To Top](#)



The Washington Post

Energy and Environment

The melting of Antarctica was already really bad. It just got worse.

By Chris Mooney March 16 at 12:17 PM

A hundred years from now, humans may remember 2014 as the year that we first learned that we may have irreversibly destabilized the great ice sheet of West Antarctica, and thus set in motion more than 10 feet of sea level rise.

Meanwhile, 2015 could be the year of the double whammy — when we learned the same about one gigantic glacier of East Antarctica, which could set in motion roughly the same amount all over again. Northern Hemisphere residents and Americans in particular should take note — when the bottom of the world loses vast amounts of ice, those of us living closer to its top get *more* sea level rise than the rest of the planet, thanks to the law of gravity.

The findings about East Antarctica emerge from a new paper just out in Nature Geoscience by an international team of scientists representing the United States, Britain, France and Australia. They flew a number of research flights over the Totten Glacier of East Antarctica — the fastest-thinning sector of the world's largest ice sheet — and took a variety of measurements to try to figure out the reasons behind its retreat. And the news wasn't good: It appears that Totten, too, is losing ice because warm ocean water is getting underneath it.

“The idea of warm ocean water eroding the ice in West Antarctica, what we’re finding is that may well be applicable in East Antarctica as well,” says Martin Siegert, a co-author of the study and who is based at the Grantham Institute at Imperial College London.

[Research casts alarming light on the decline of West Antarctic glaciers]

The Totten Glacier covers an area of 40 miles by 18 miles. It is losing an amount of ice “equivalent to 100 times the volume of Sydney Harbour every year,” notes the Australian Antarctic Division.

That’s alarming, because the glacier holds back a much more vast catchment of ice that, were its vulnerable parts to flow into the ocean, could produce a sea level rise of more than 11 feet — which is comparable to the impact from a loss of the West Antarctica ice sheet. And that’s “a conservative lower limit,” says lead study author Jamin Greenbaum, a PhD candidate at the University of Texas at Austin.

In its alignment with the land and the sea, the Totten Glacier is similar to the West Antarctic glaciers, which also feature ice shelves that slope out from the vast sheet of ice on land and extend into the water. These ice shelves are a key source of instability, because if ocean waters beneath them warm, they can lose ice rapidly, allowing the ice sheet behind them to flow more quickly into the sea.

The researchers used three separate types of measurements taken during their flights — gravitational measurements, radar and laser altimetry — to get a glimpse of what might be happening beneath the massive glacier, whose ice shelves are more than 1,600 feet thick in places. Using radar, they could measure the ice’s thickness. Meanwhile, by measuring the pull of the Earth’s gravity on the airplane in different places, the scientists were able to determine just how far below that ice the seafloor was.

The result was the discovery of two undersea troughs or valleys beneath the ice shelf —

regions where the seafloor slopes downward, allowing a greater depth of water beneath the floating ice. These cavities or subsea valleys, the researchers suggest, may explain the glacier's retreat — they could allow warmer deep waters to get underneath the ice shelf, accelerating its melting.

In this particular area of Antarctica, Greenbaum says, a warmer layer of ocean water offshore is actually deeper than the colder layers above it, because of the saltwater content of the warm water (which increases its density). And the canyons may allow that warm water access to the glacier base. “What we found here is that there are seafloor valleys deeper than the depth of the maximum temperature measured near the glacier,” Greenbaum says.

One of these canyons is three miles wide, in a region that was previously believed to simply hold ice lying atop solid earth. On the contrary, the new study suggests the ice is instead afloat.

The availability of warm water, and the observed melting, notes the study, “support the idea that the behaviour of Totten Glacier is an East Antarctic analogue to ocean-driven retreat underway in the West Antarctic Ice Sheet (WAIS). The global sea level potential of 3.5 m flowing through Totten Glacier alone is of similar magnitude to the entire probable contribution of the WAIS.”

One limitation of the study is that the scientists were not able to directly measure the temperature of ocean water that is reaching the glacier itself. While this could be done with robotic underwater vehicles or other methods, that wasn't part of the study at this time. Thus, the conclusions are more focused on inferring the vulnerability of the glacier based on a number of different pieces of evidence — topped off by the fact that the glacier is, indeed, retreating.

[These subsea drones are figuring out just how badly we are messing up the planet]

For residents of the United States — and indeed, the entire Northern Hemisphere — the impact could be more dire. If Antarctica loses volumes of ice that would translate into major contributions to sea level rise, that rise would not be distributed evenly around the globe. The reason is the force of gravity. Antarctica is so massive that it pulls the ocean toward it, but if it loses ice, that gravitational pull will relax, and the ocean will slosh back toward the Northern Hemisphere — which will experience additional sea level rise.

For the United States, the amount of sea level rise could be 25 percent or more than the global average.

[The U.S. has caused more global warming than any other country. Here's how the Earth will get its revenge]

Much as with the ocean-abutting glaciers of West Antarctica, just because a retreat has been observed — and because the entirety of the region implies a sea level rise of 11 or more feet were all ice to end up in the ocean — does not mean that we'll see anything near that much sea level rise in our lifetimes. These processes generally are expected to play out over hundreds of years or more. They would reshape the face of the Earth — but we may never see it.

The problem, then, is more the world we're leaving to our children and grandchildren — because once such a gigantic geophysical process begins, it's hard to see how it comes to a halt. “With warming oceans, it's difficult to see how a process that starts now would be reversed, or reversible, in a warming world,” Siegert says.

Thanks for reading our new Energy & Environment coverage! You can sign up for our weekly newsletter [here](#) and follow our tweets [here](#). Also in Energy & Environment:

Your desktop computer is wasting a lot of energy while you're not using it

